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Park et al.

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(54) **VACUUM CLEANER**

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A47L 9/00 (2006.01)
A47L 5/22 (2006.01)
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CPC ***A47L 9/0081*** (2013.01); ***A47L 5/22*** (2013.01); ***A47L 5/225*** (2013.01); ***F04D 25/08*** (2013.01);
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(58) **Field of Classification Search**
None
See application file for complete search history.

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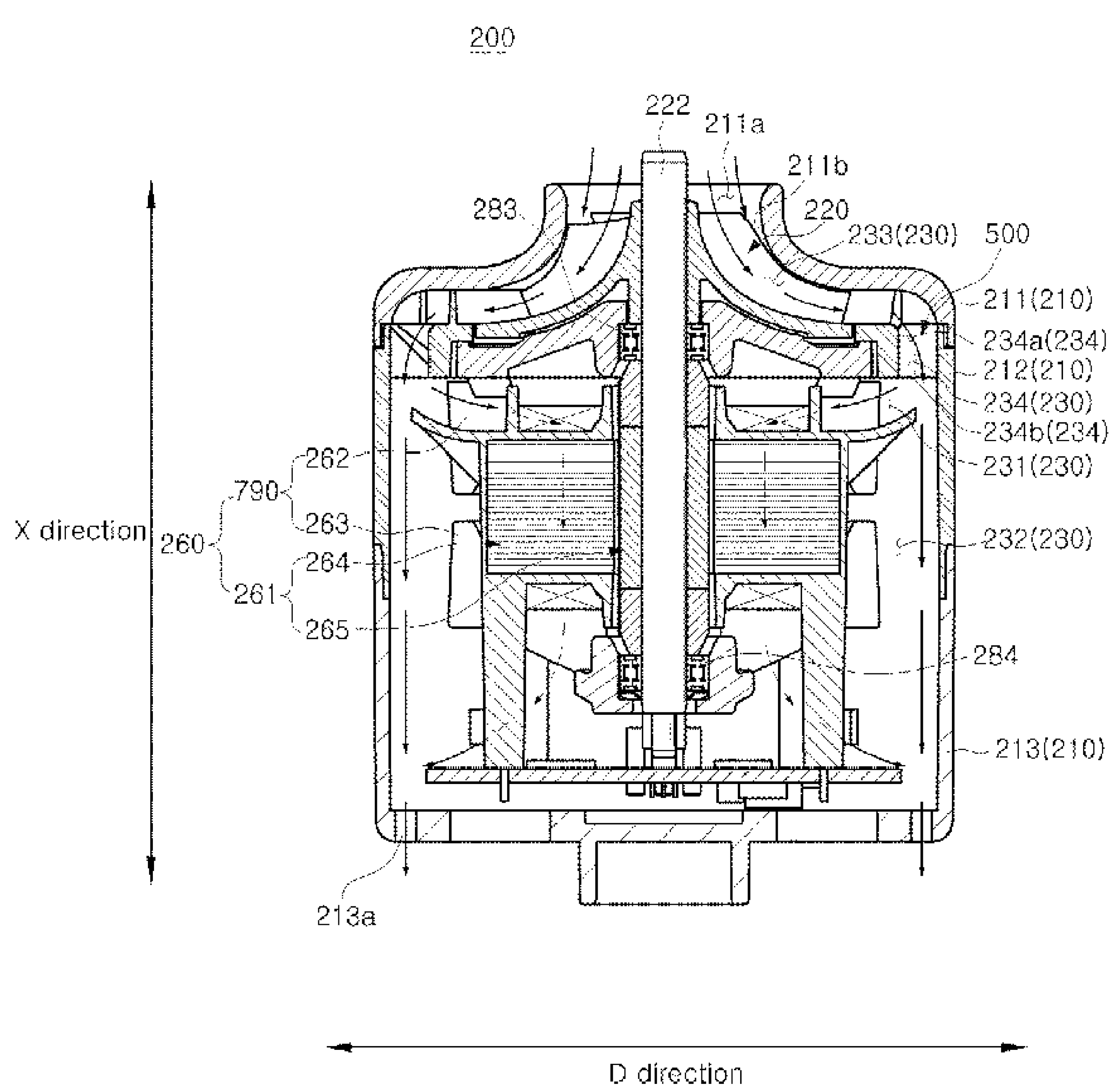
(57) **ABSTRACT**

A vacuum cleaner having an improved structure capable of enhancing suction performance includes a suction unit provided in a main body, the suction unit including an impeller disposed to suck air by rotating about an axis thereof, and a diffuser disposed to guide air discharged from the impeller. The diffuser includes an inner casing, an outer casing disposed to be spaced apart from an outer circumference of the inner casing and to form a path through which the air discharged from the impeller flows, and a plurality of vanes disposed at the inner casing to guide the air discharged from the impeller to the path, and the plurality of vanes protrude toward the outer casing to cross at least a part of the path.

23 Claims, 25 Drawing Sheets



(51) **Int. Cl.**

F04D 29/44	(2006.01)
F04D 25/08	(2006.01)
F04D 29/42	(2006.01)
F04D 29/62	(2006.01)

(52) **U.S. Cl.**
CPC ***F04D 29/4253*** (2013.01); ***F04D 29/444*** (2013.01); ***F04D 29/626*** (2013.01)

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FIG.1

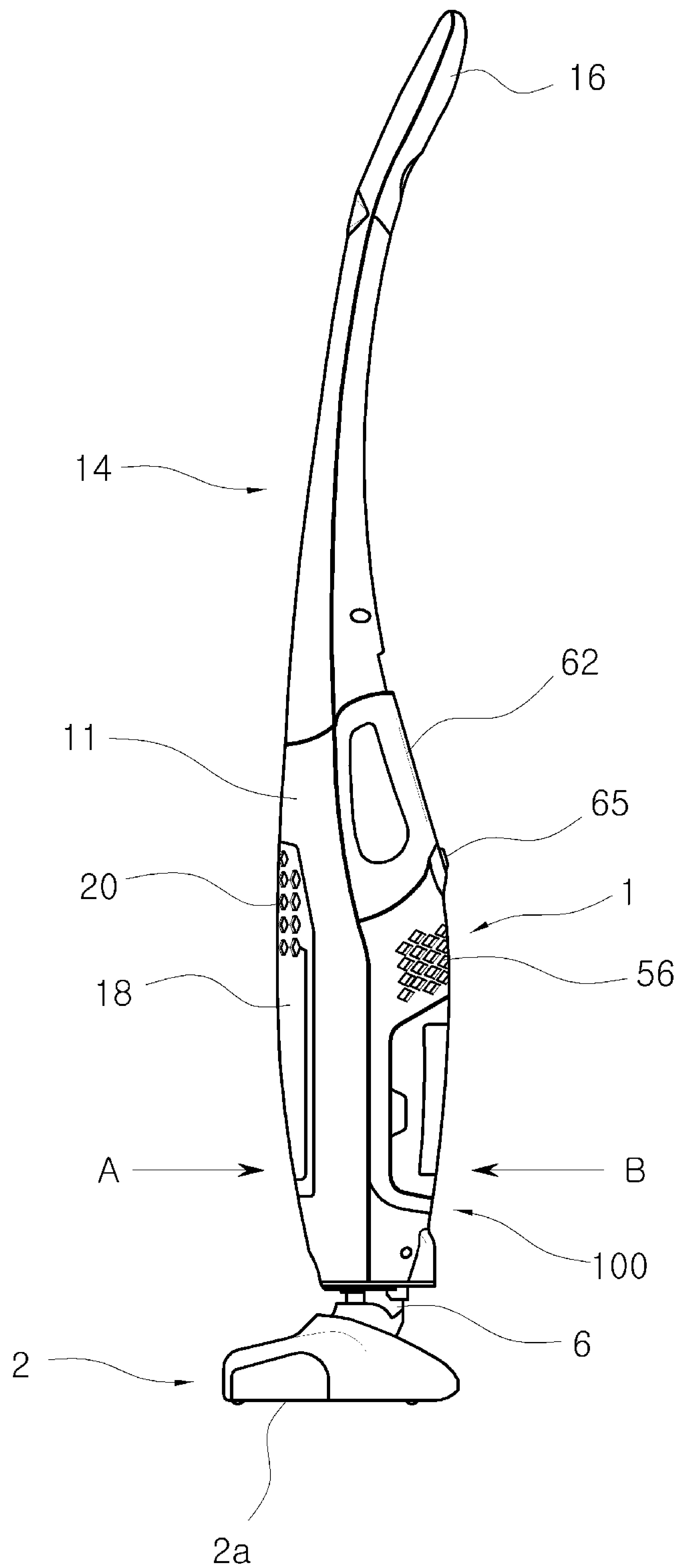


FIG.2

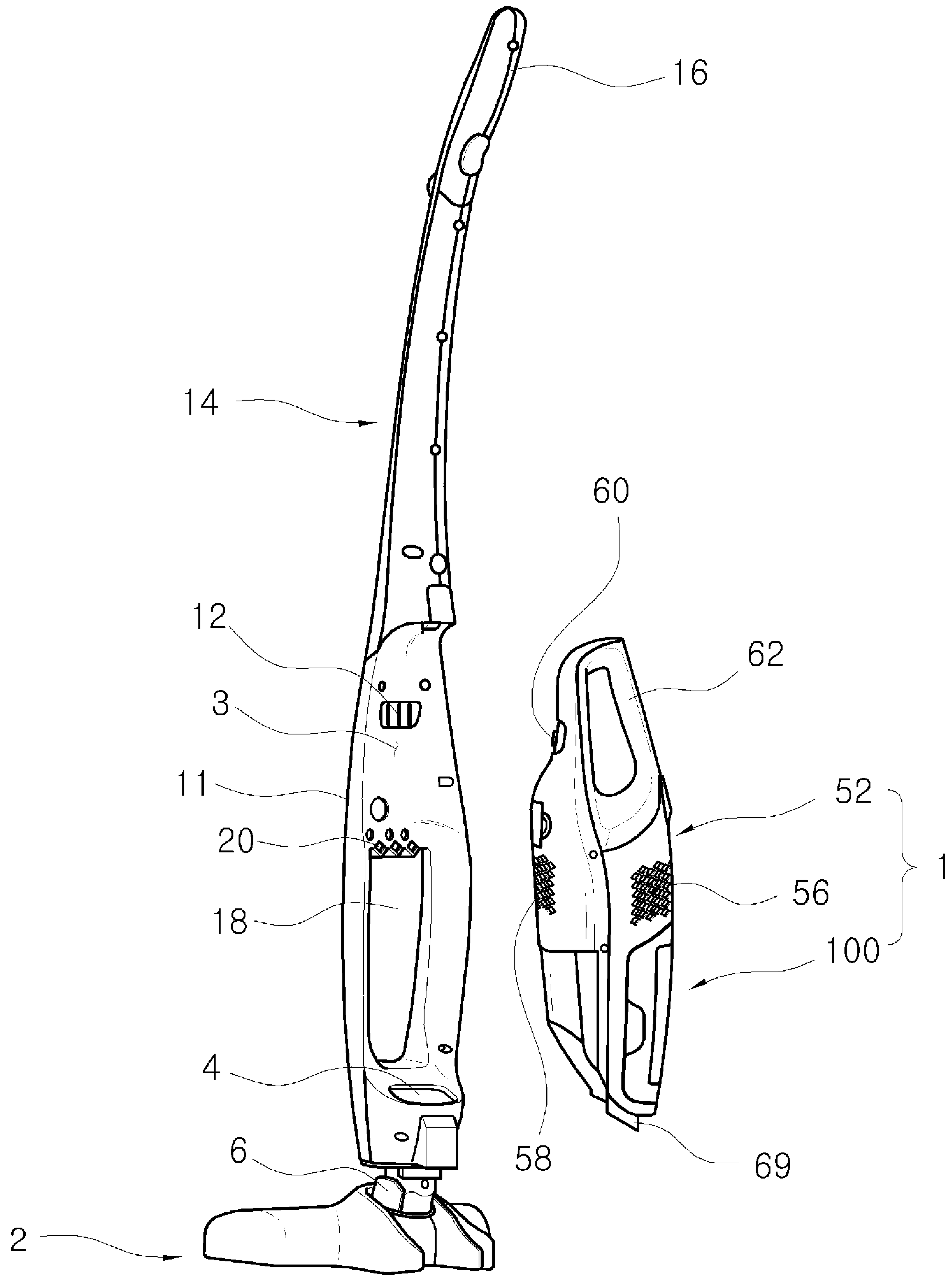


FIG.3

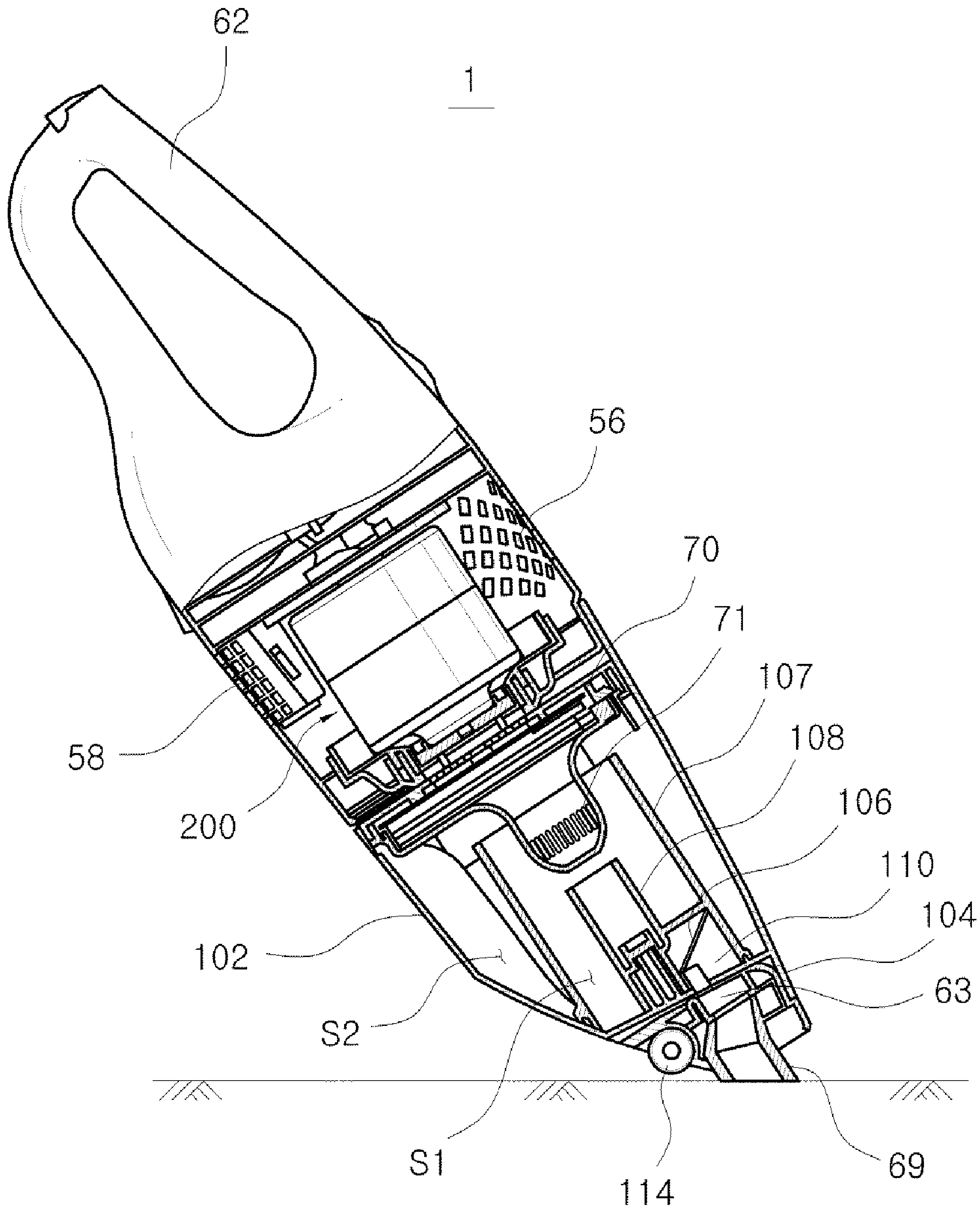


FIG.4

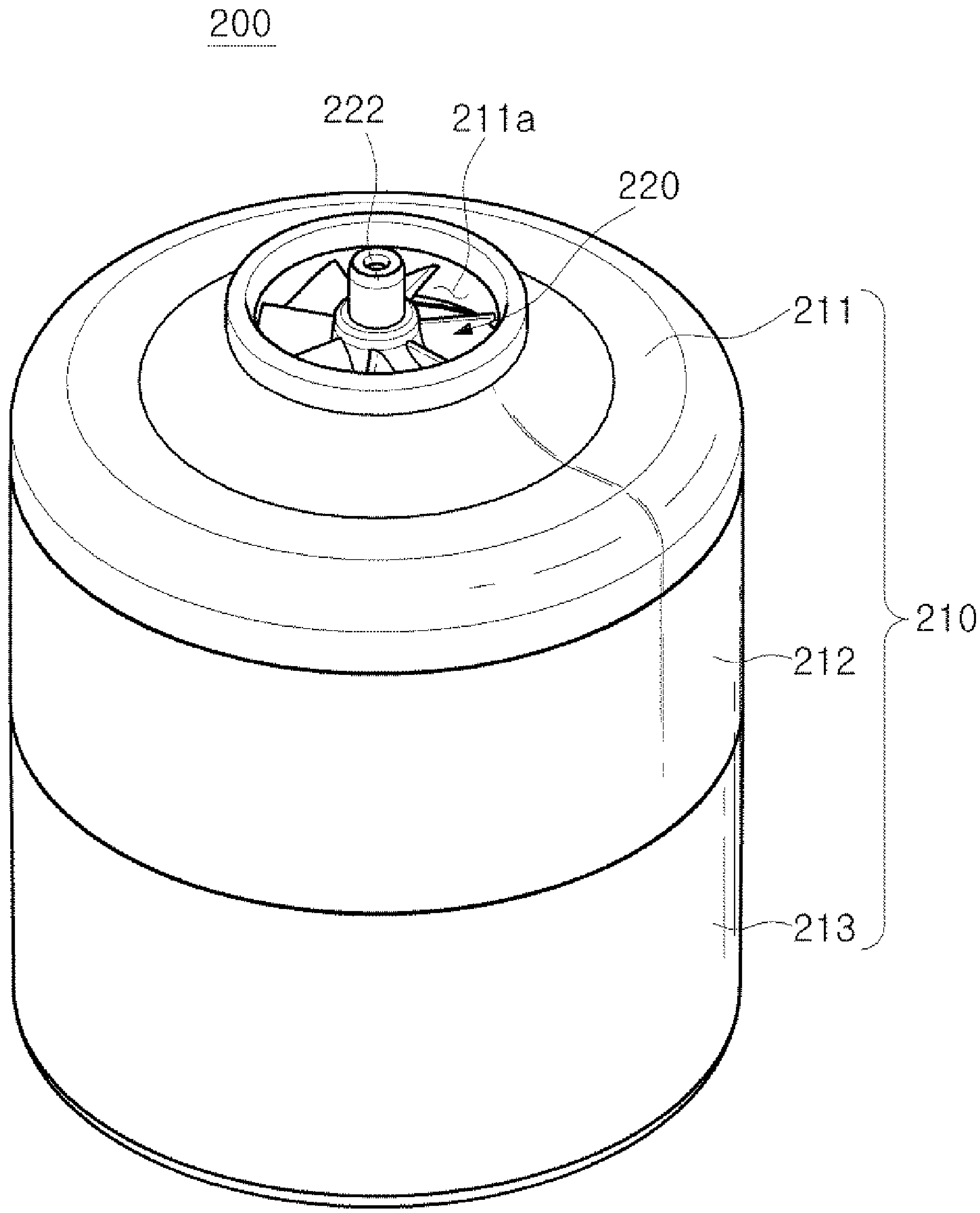
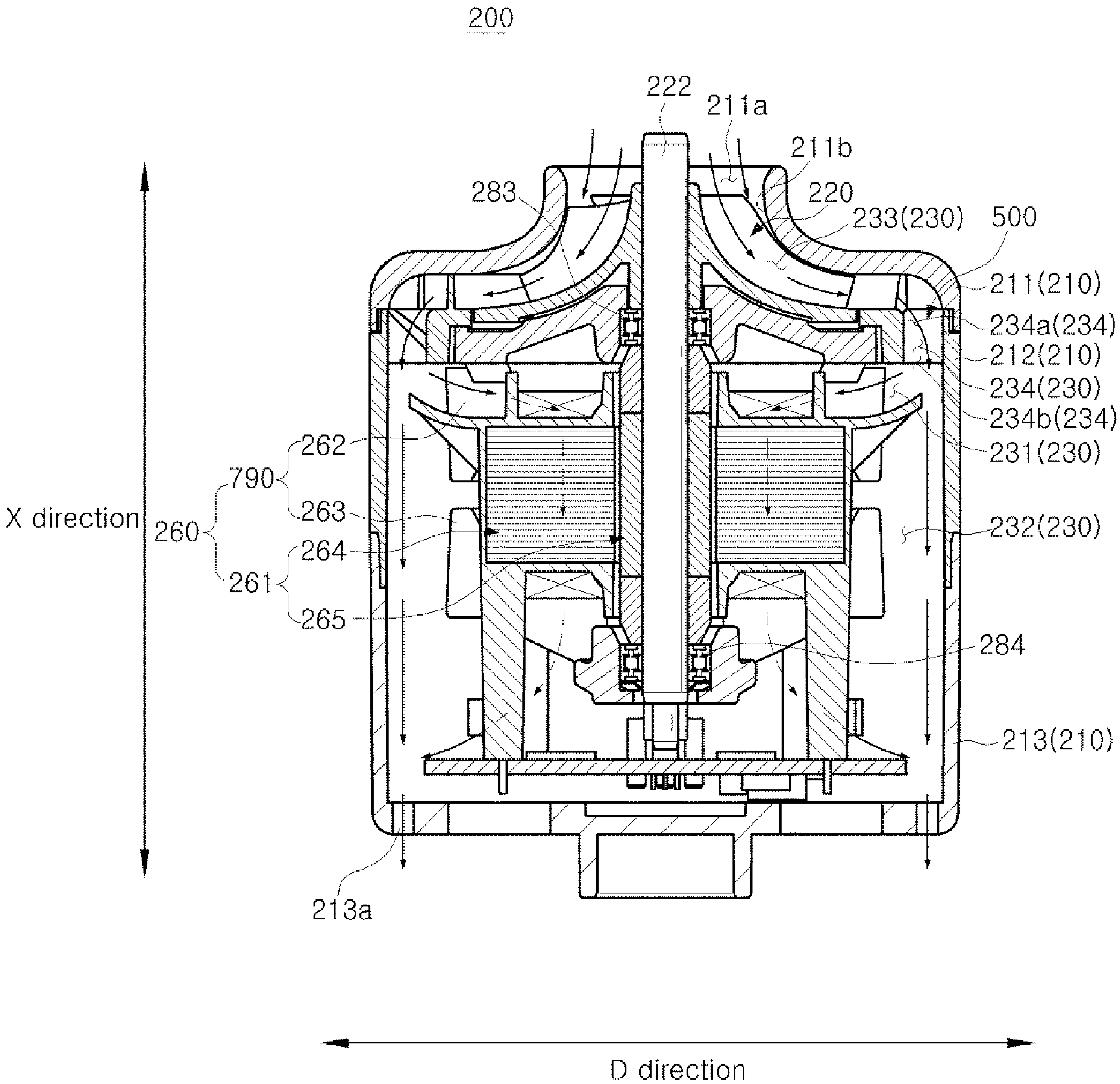


FIG.5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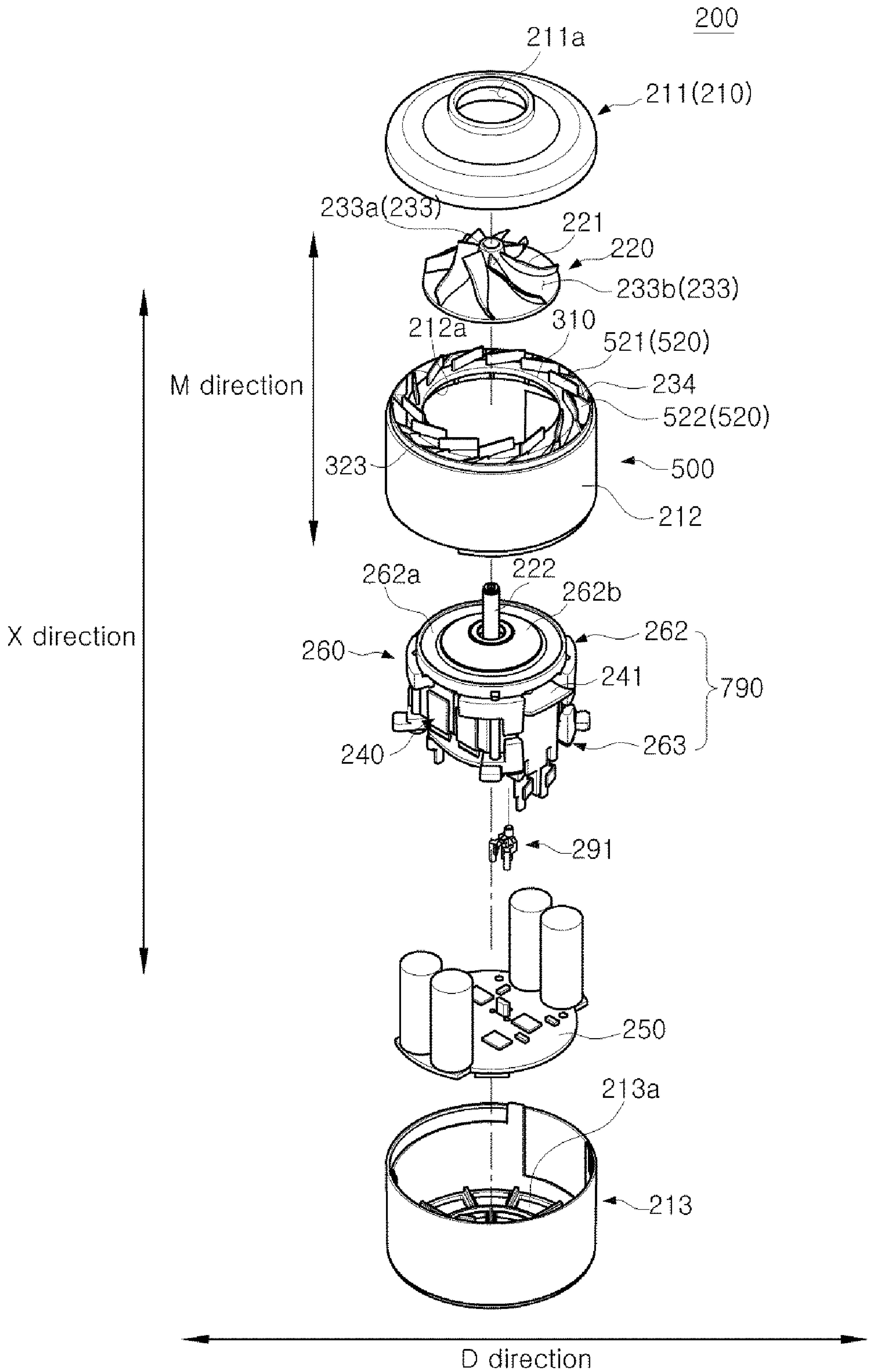
211(210)
234a(234)
212(210)
234(230)
234b(234)
231(230)
262
790
263
X direction
260
264
261
265
232(230)
284
213(210)
213a
D direction

FIG.6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323
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X direction
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262b
262
260
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213a
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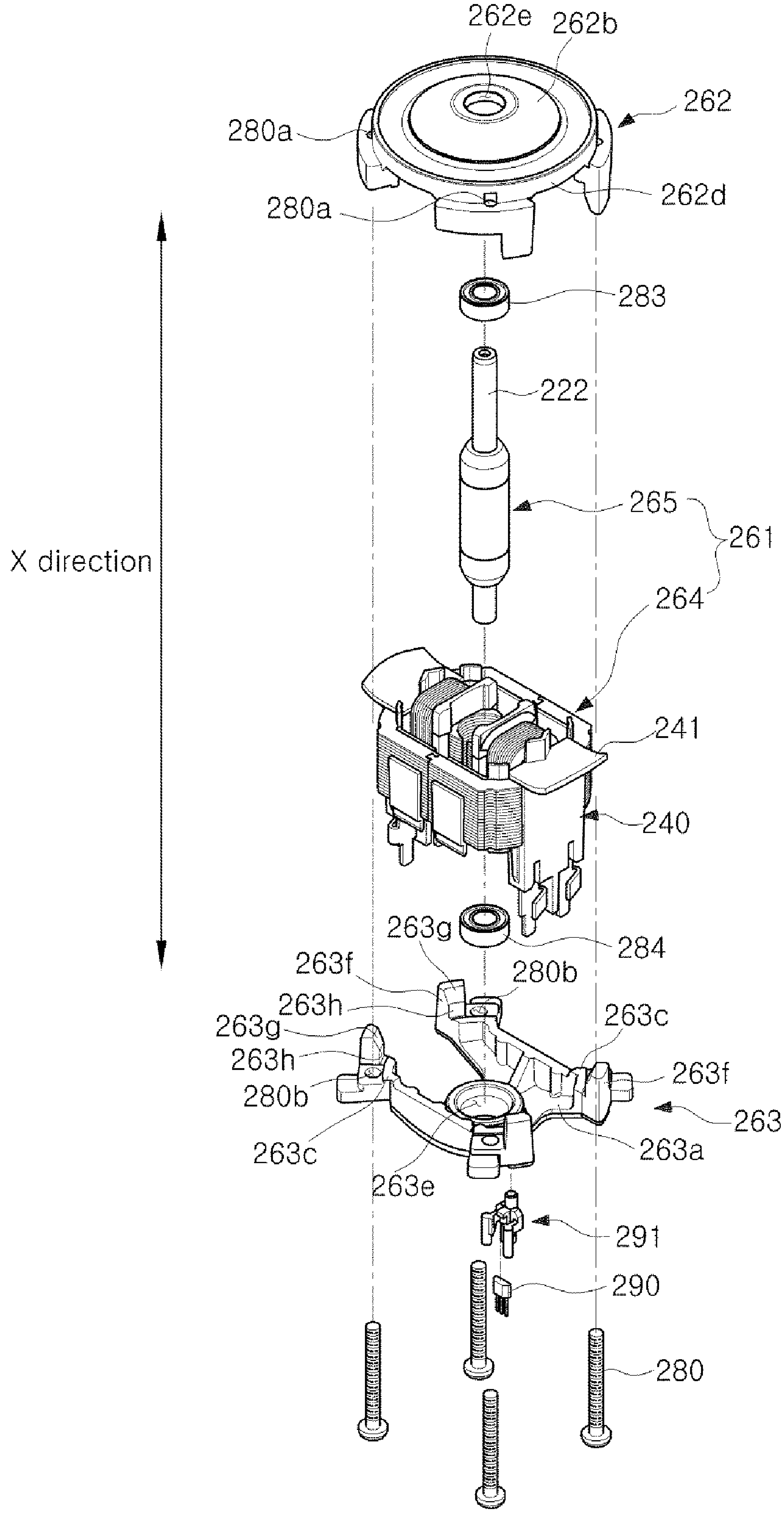
D direction

FIG.7A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262b
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280a
262d
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261
264
X direction
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263g
284
263f
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263h
263c
263g
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280b
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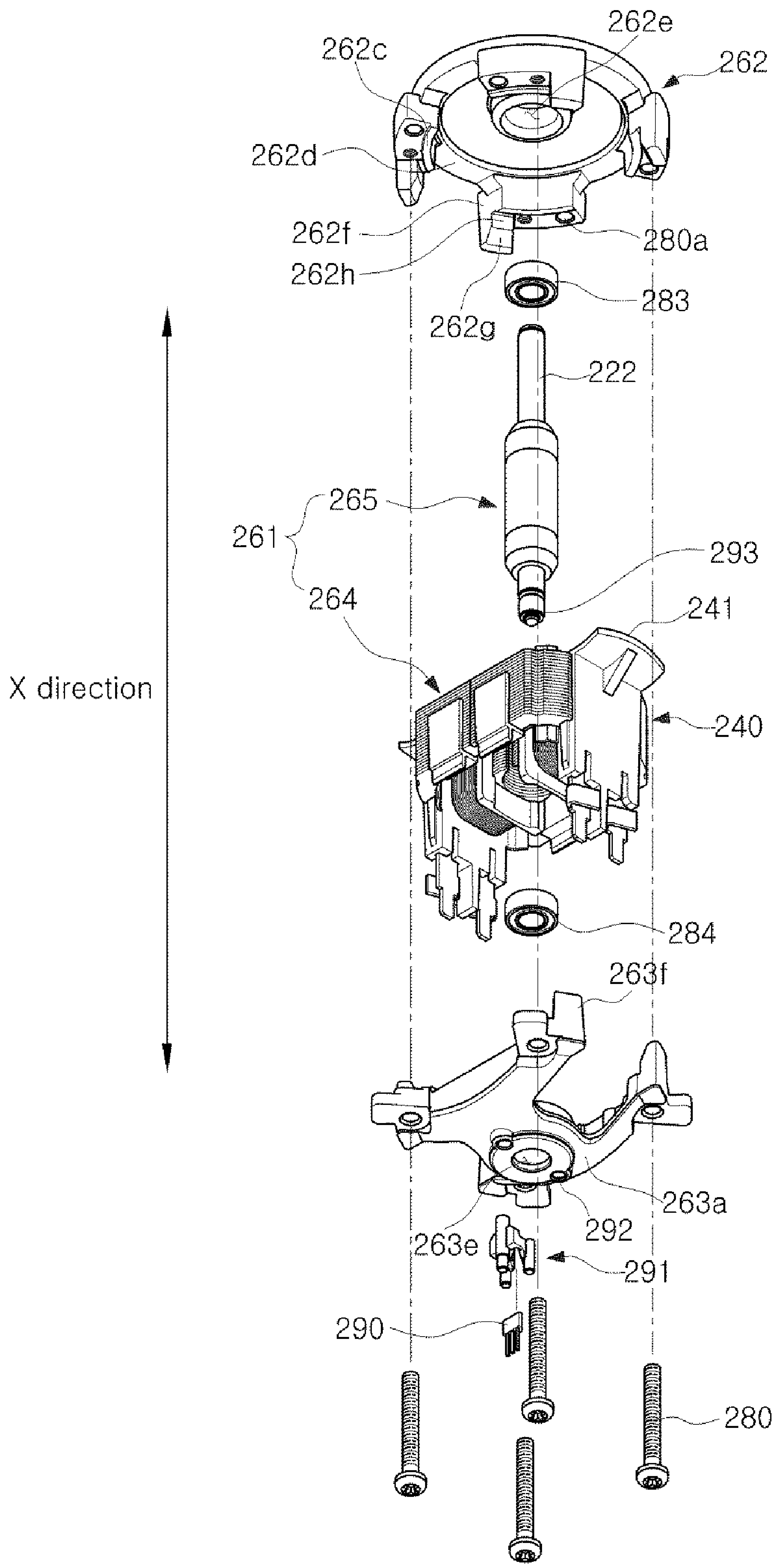
263c
263a
263e
291
290
280

FIG.7B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263a
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290
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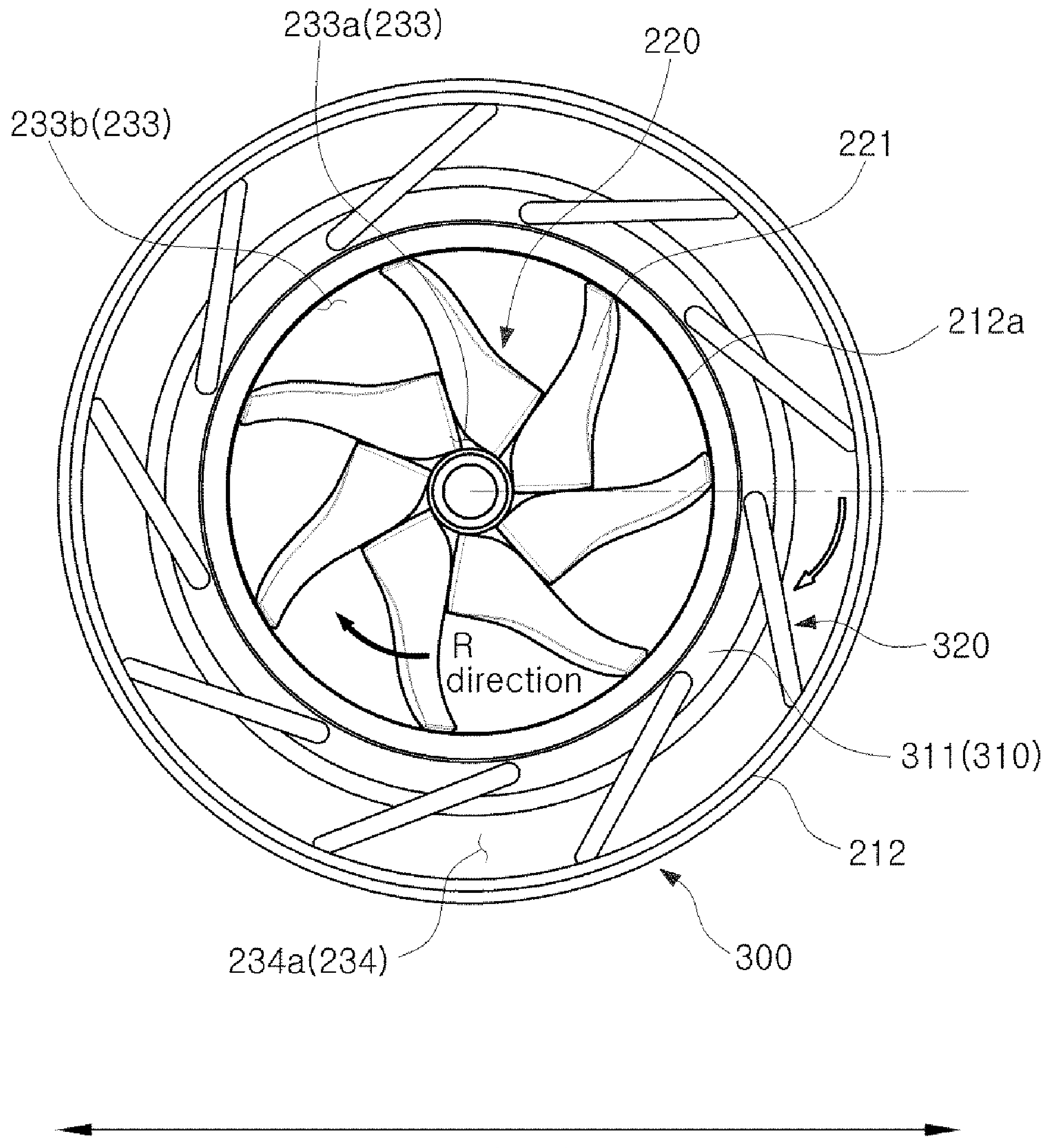
FIG.8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direction
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311(310)
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234a(234)
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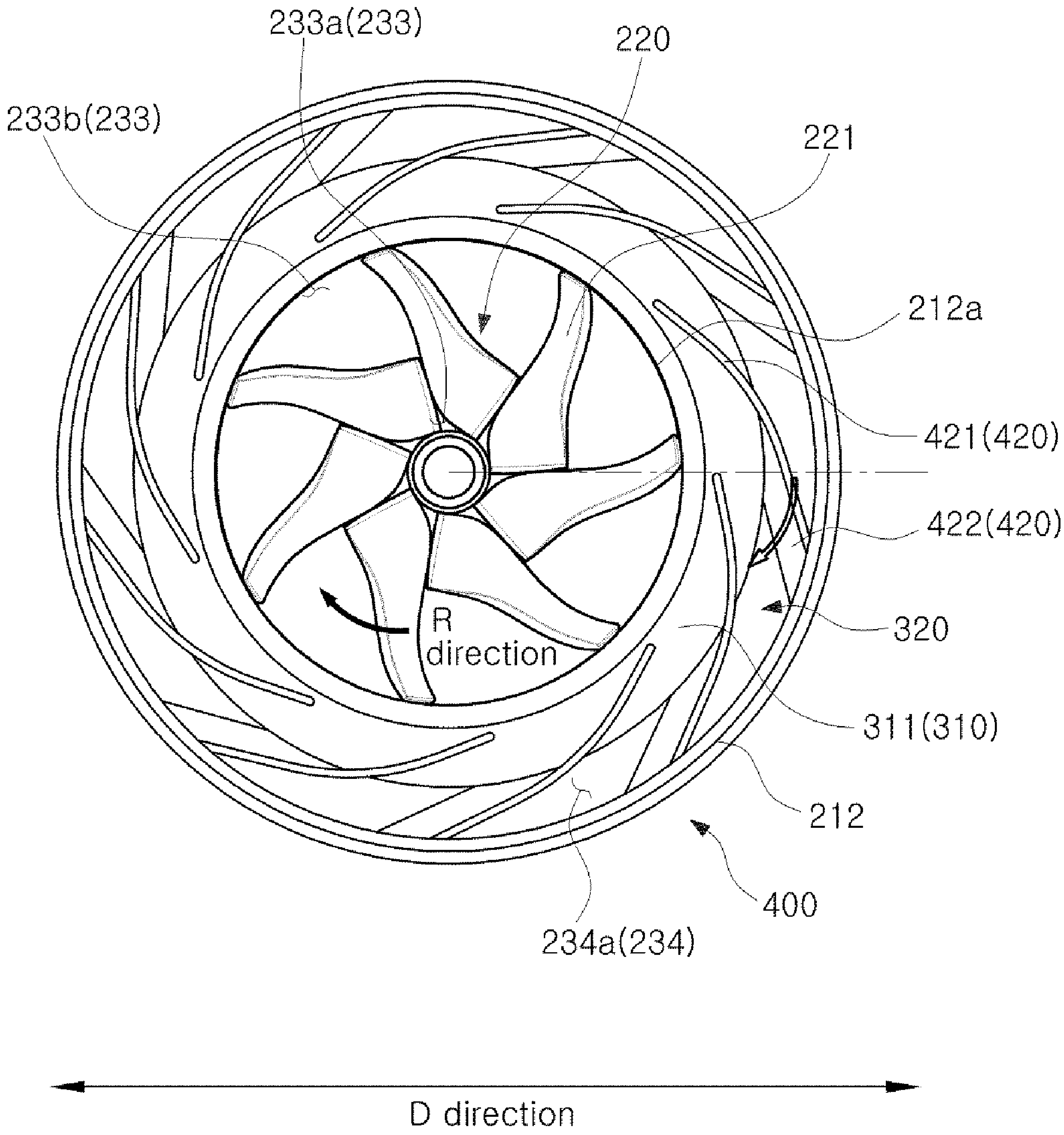
D direction

FIG.9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233b(233)
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212a
421(420)
422(420)
320
R
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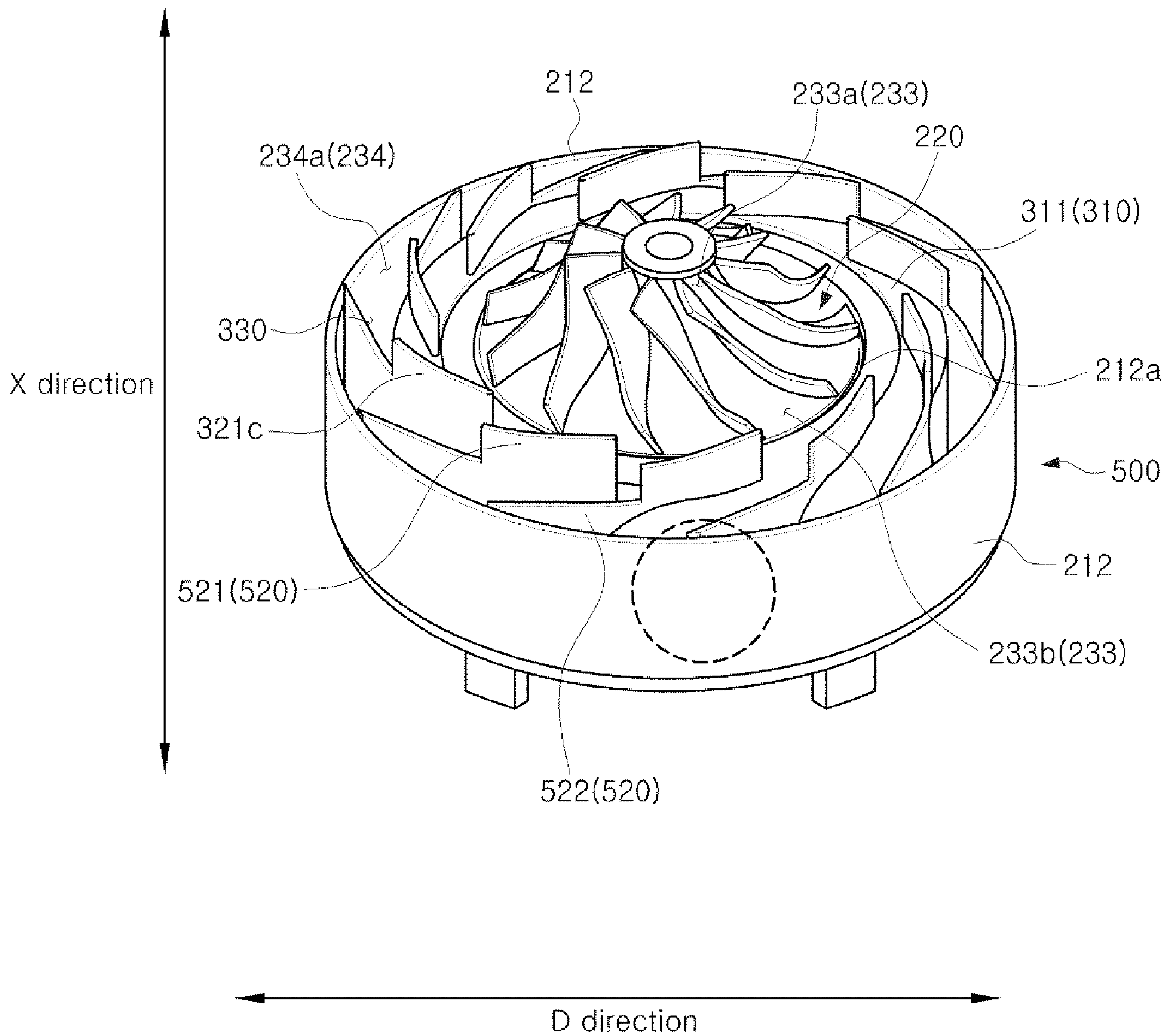
311(310)
212
400
234a(234)
D direction

FIG.10A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X direction
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521(520)
233b(233)
522(520)
D direction

FIG.10B

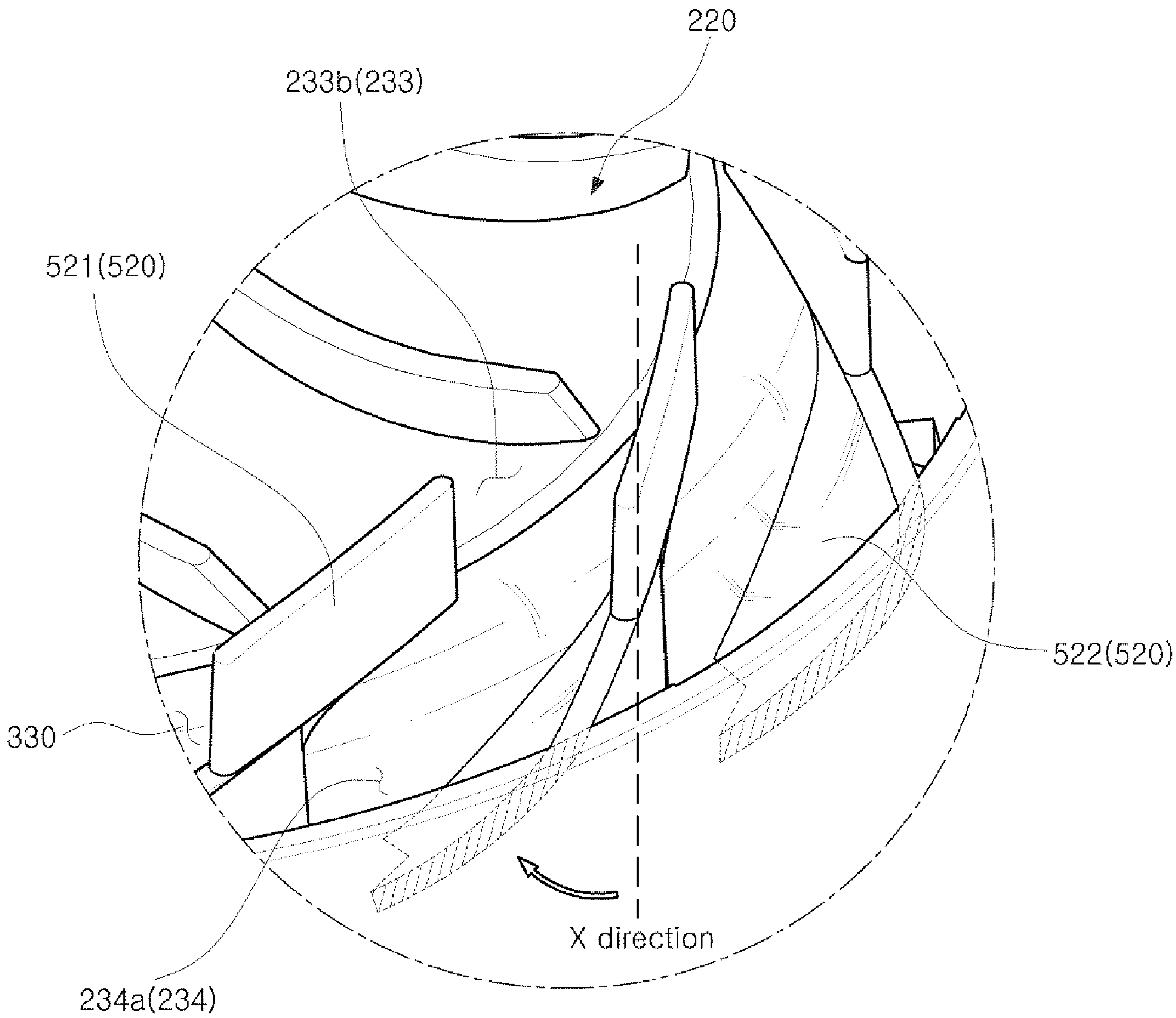
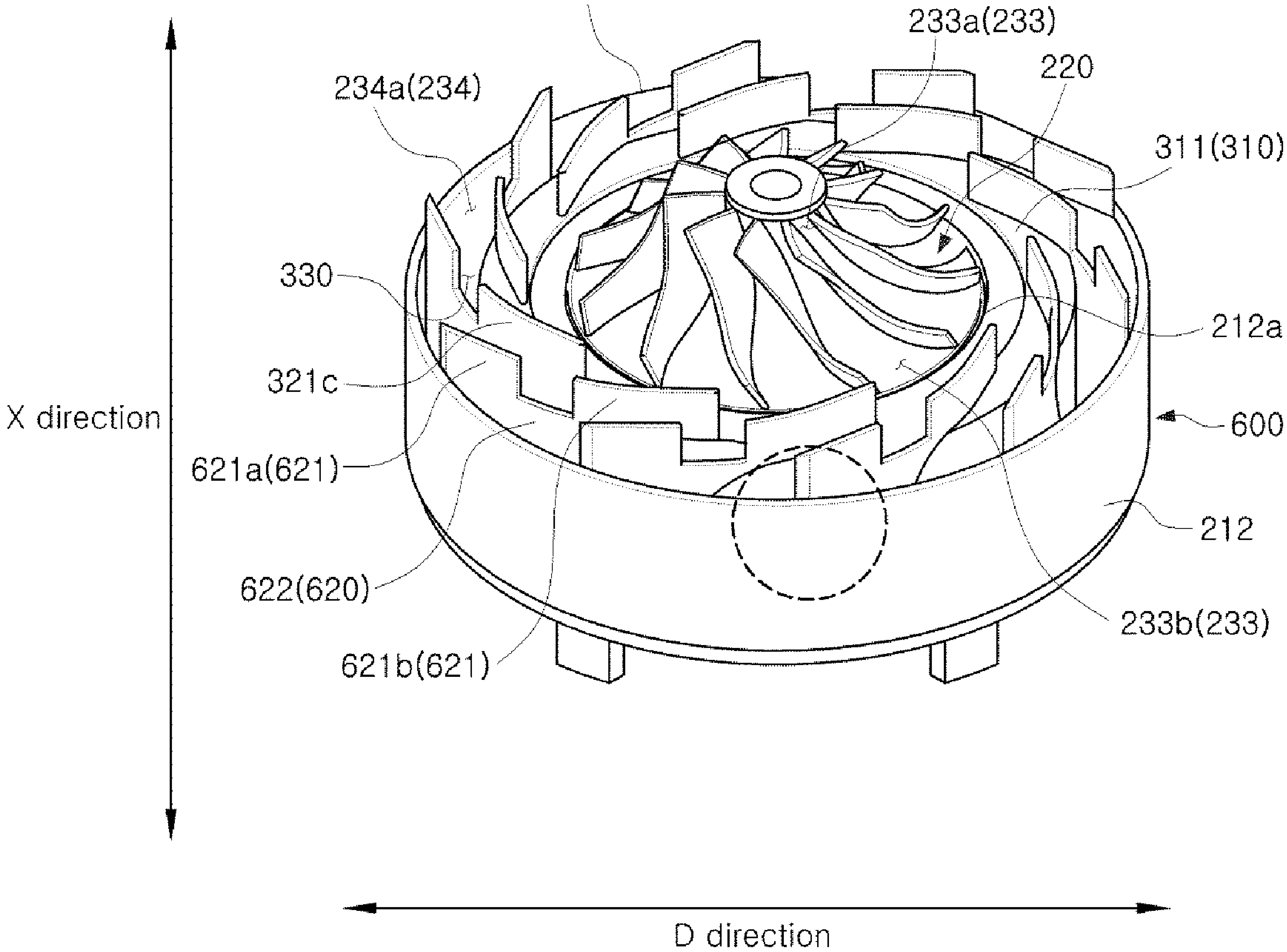


FIG.11A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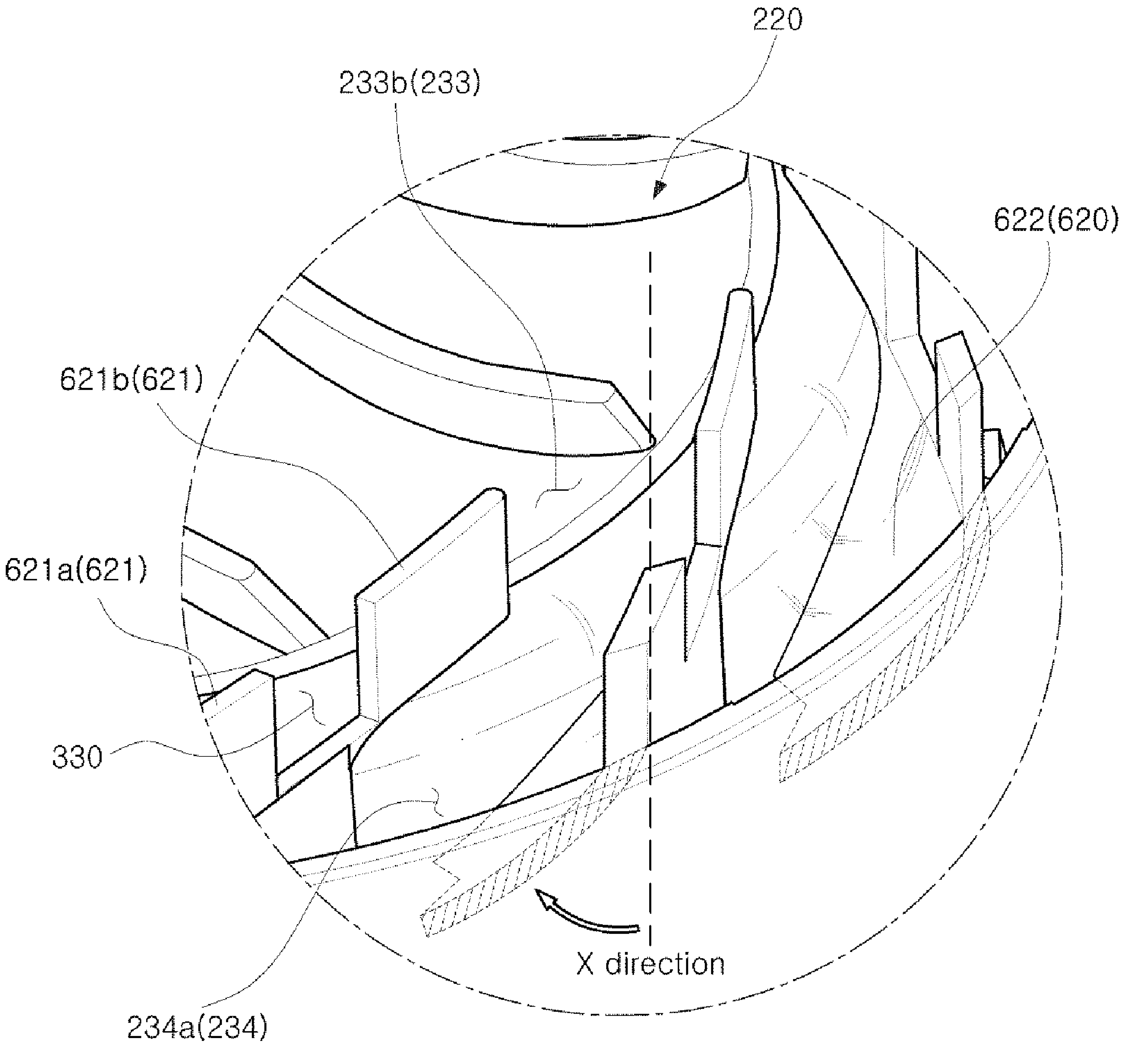
233b(233)
621b(621)
D direction

FIG.11B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622(620)
621b(621)
621a(621)
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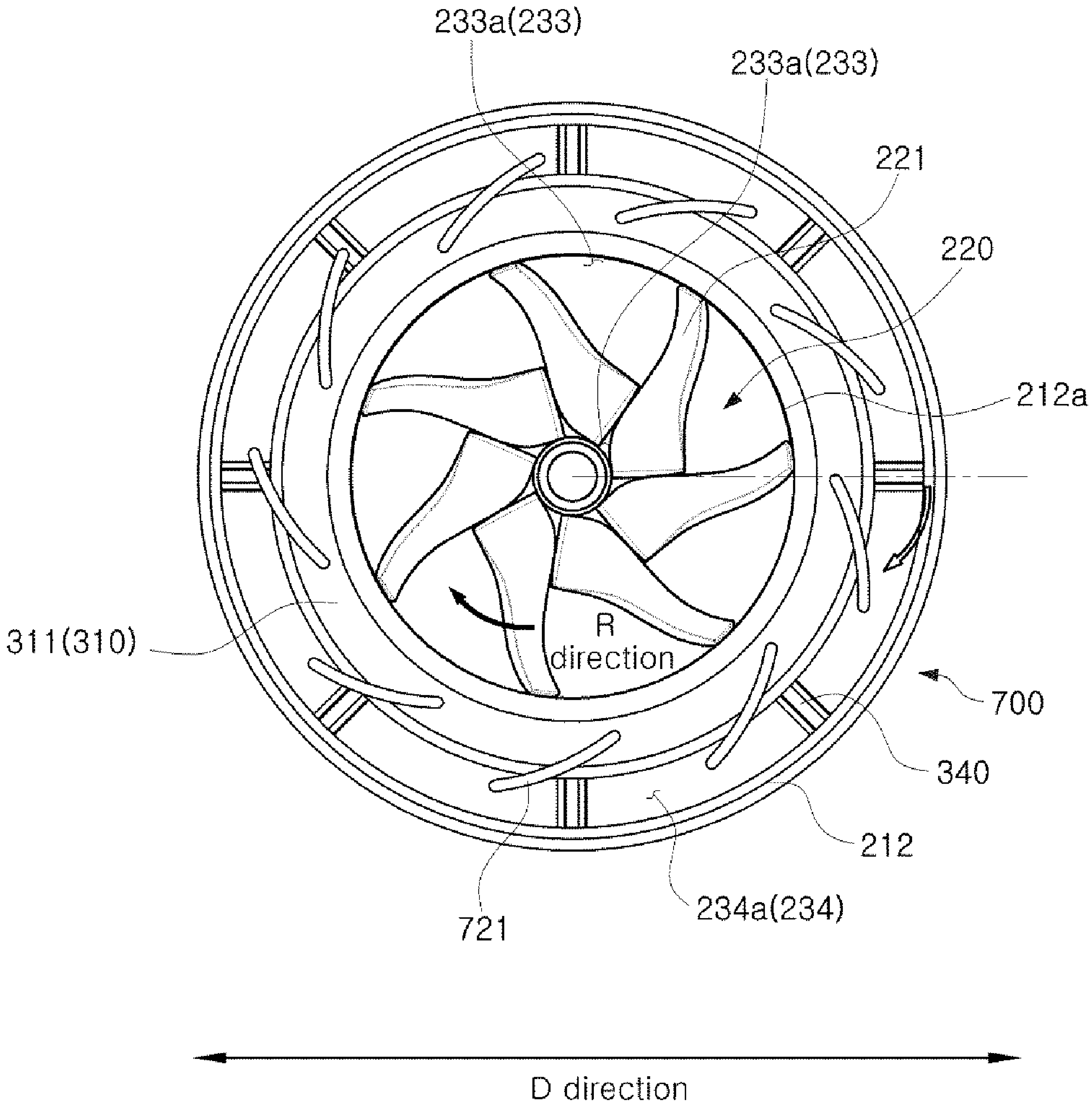
X direction
234a(234)

FIG.12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direction
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340
212
234a(234)
721
D direction

FIG.13

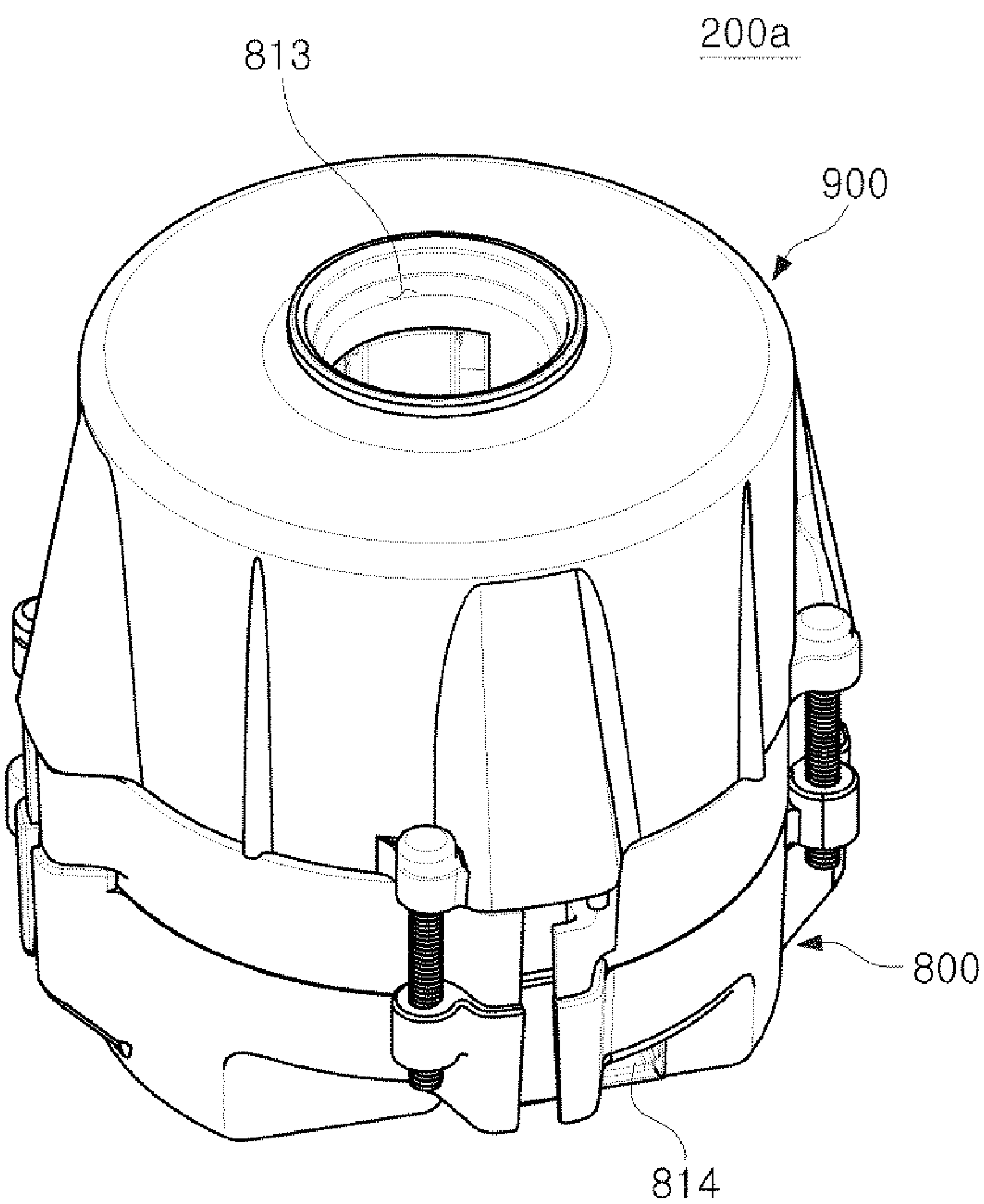
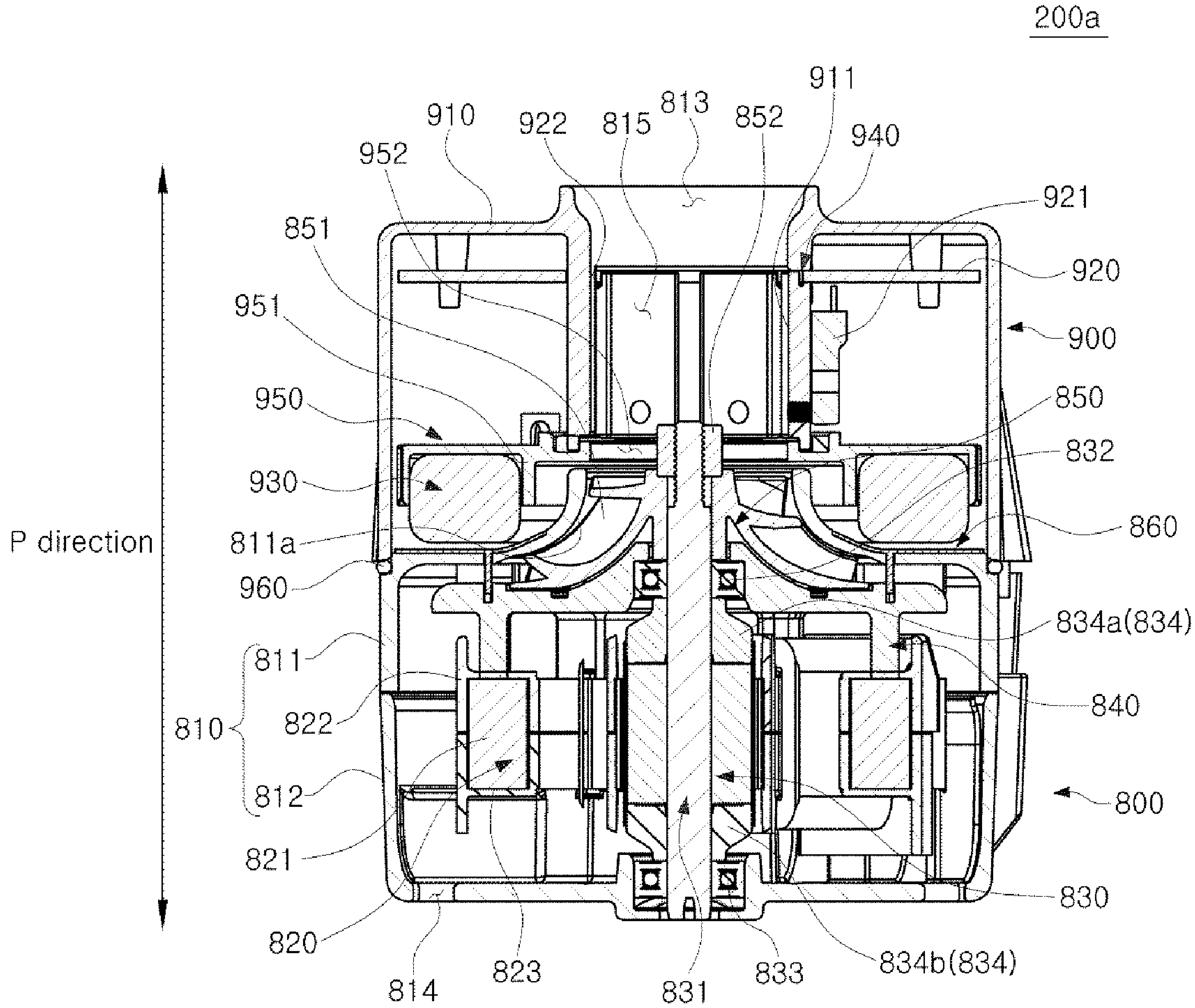


FIG.14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920
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900
950
850
832
930
860
P direction
811a
960
834a(834)
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810
822
812
800
821
830
820
834b(834)
814
823
831
833

FIG.15

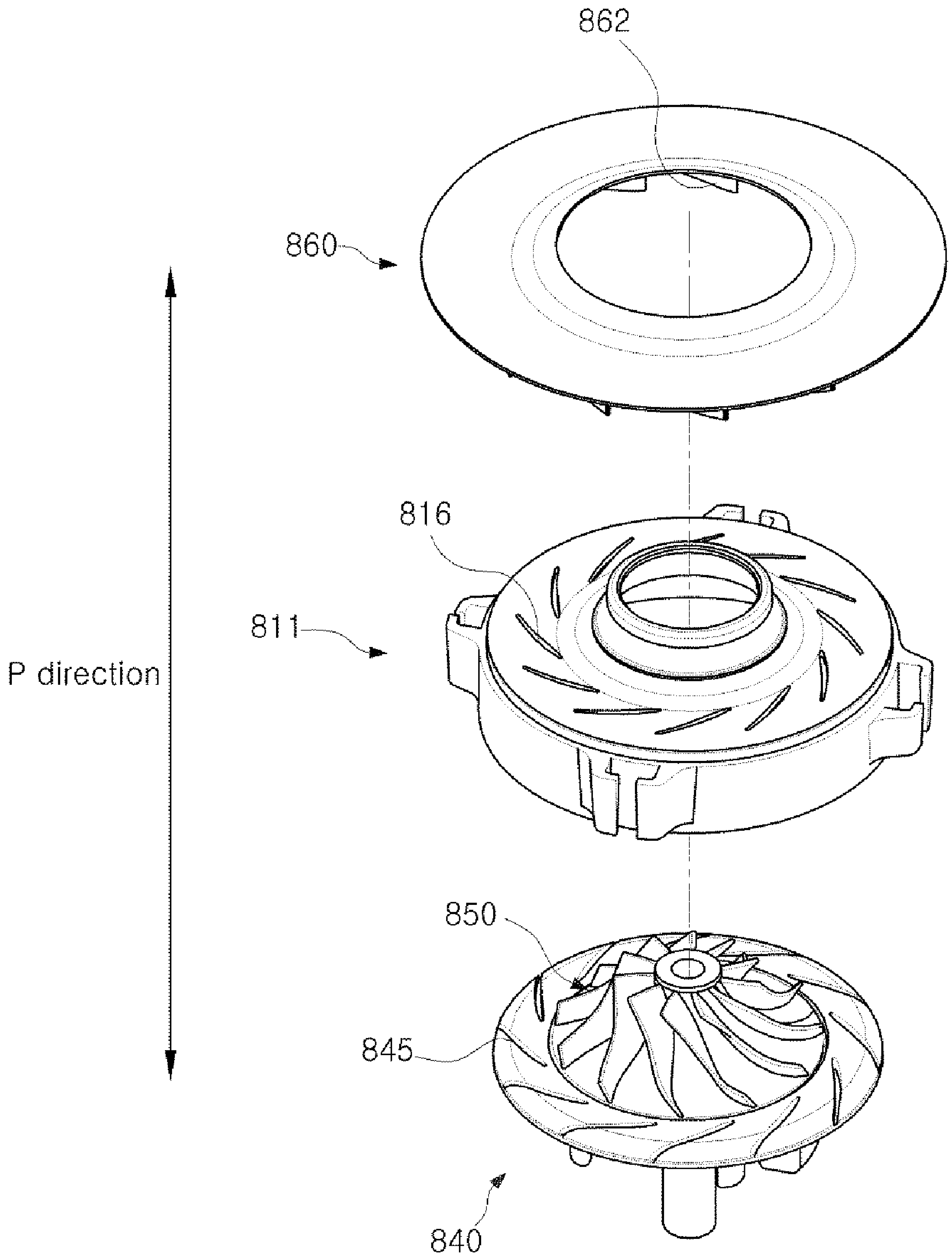


FIG.16

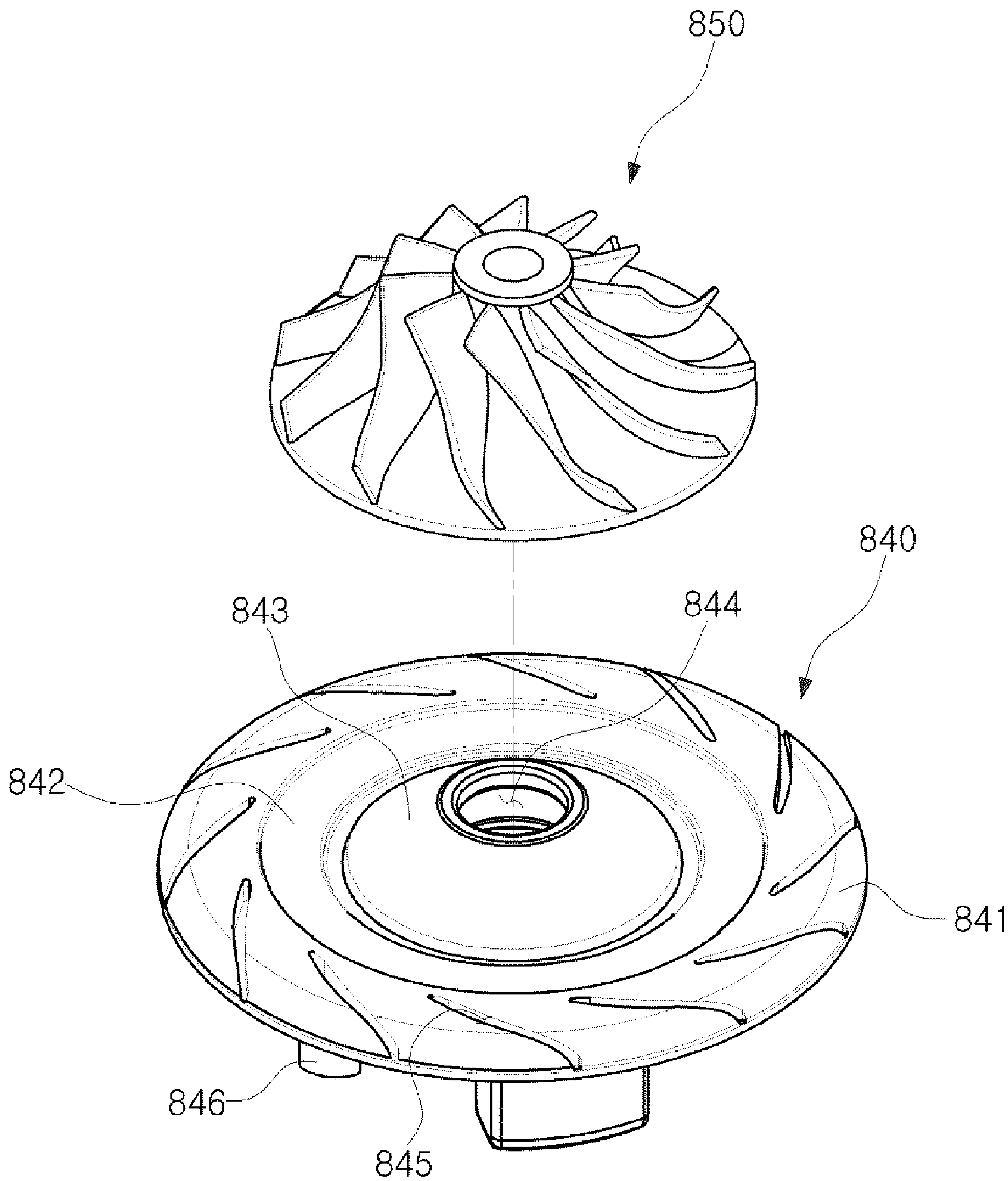


FIG.17A

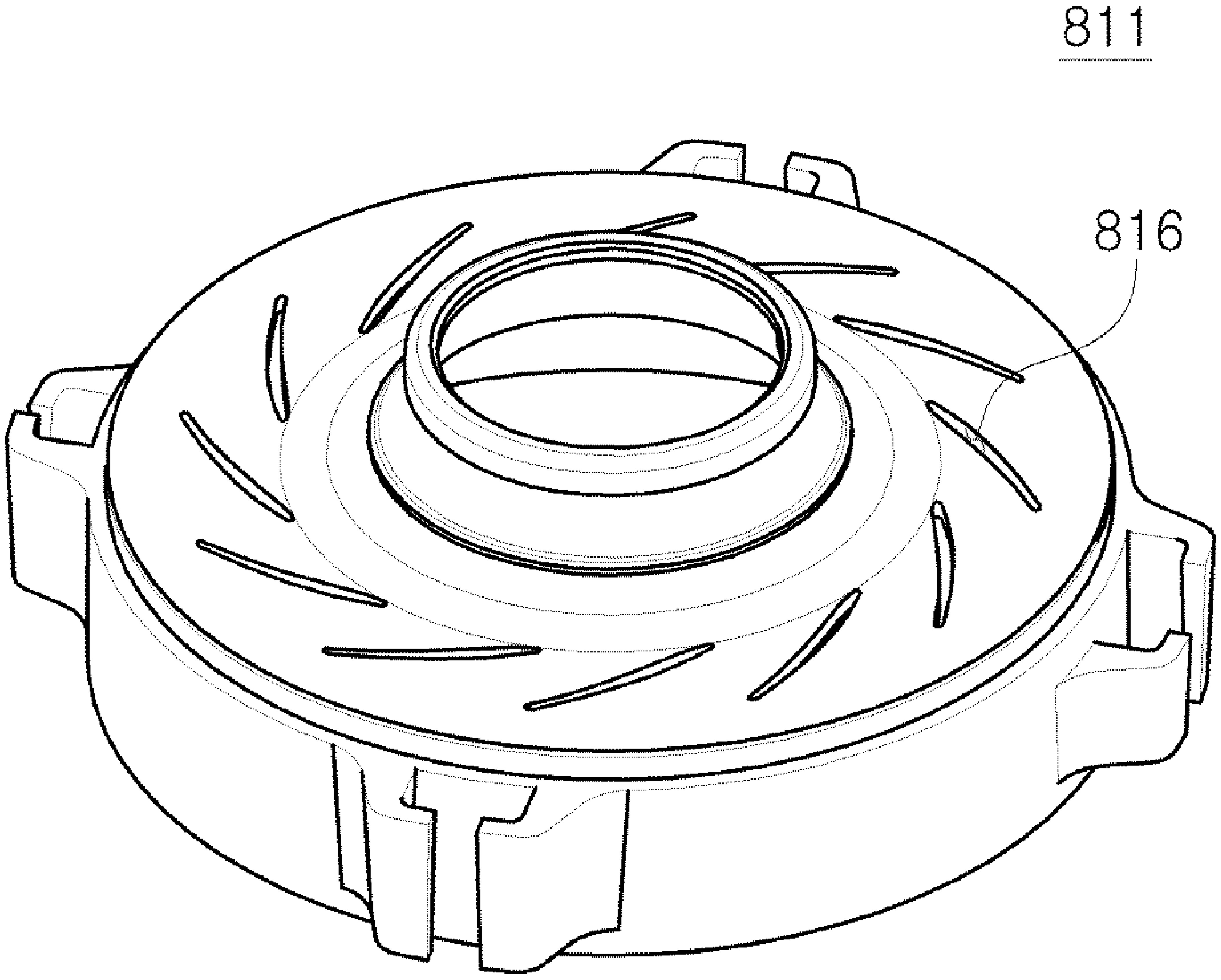


FIG.17B

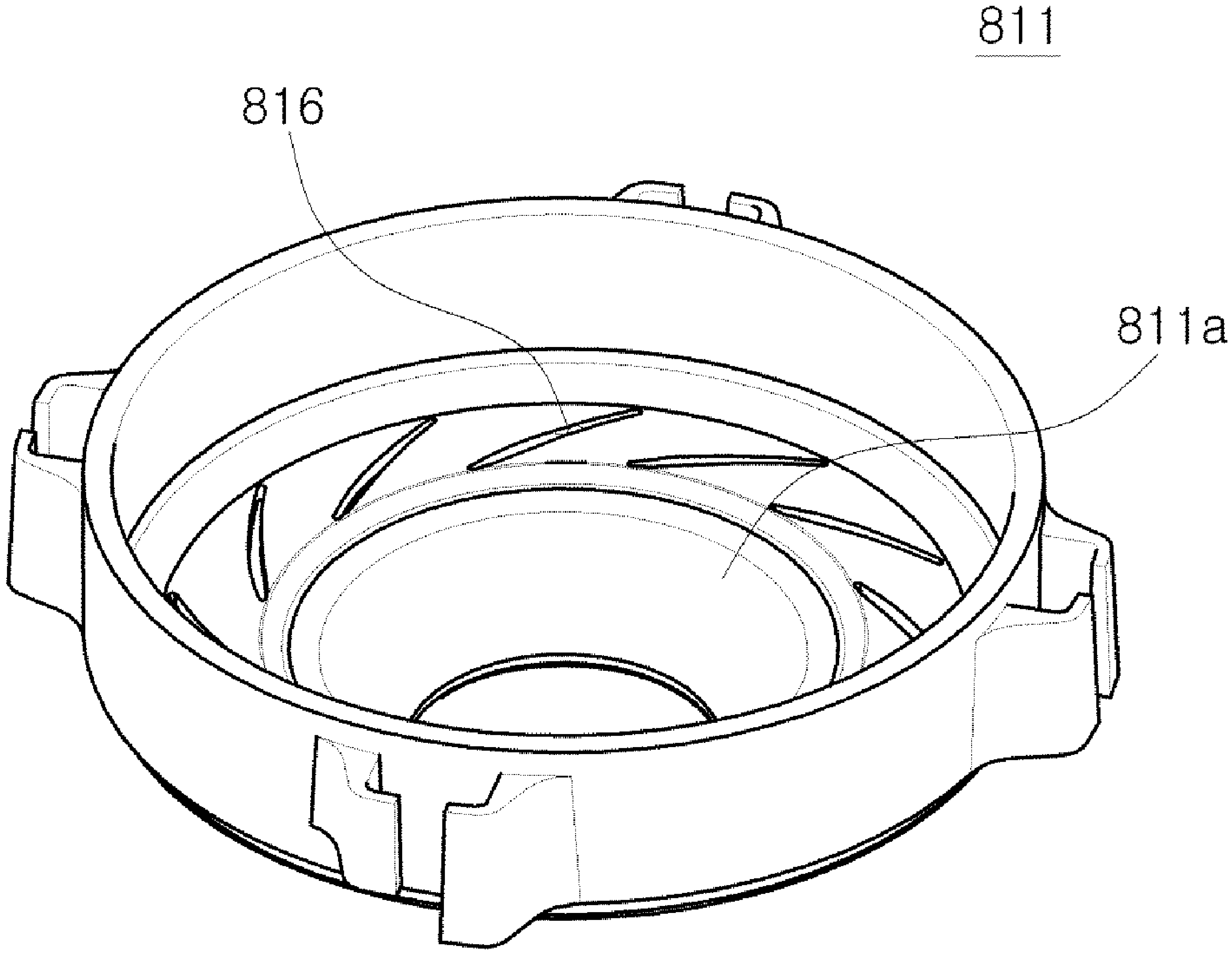


FIG.18A

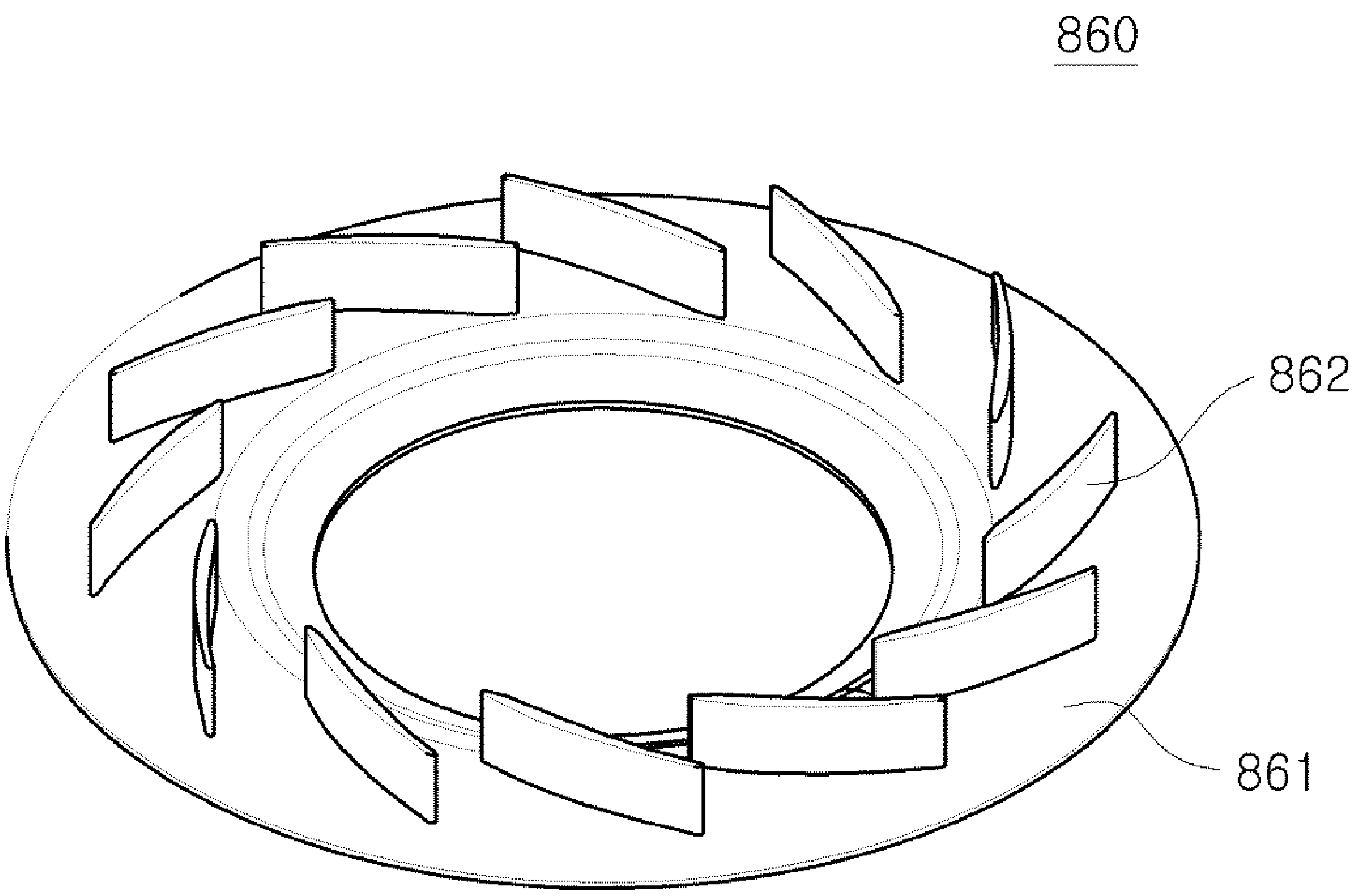


FIG.18B

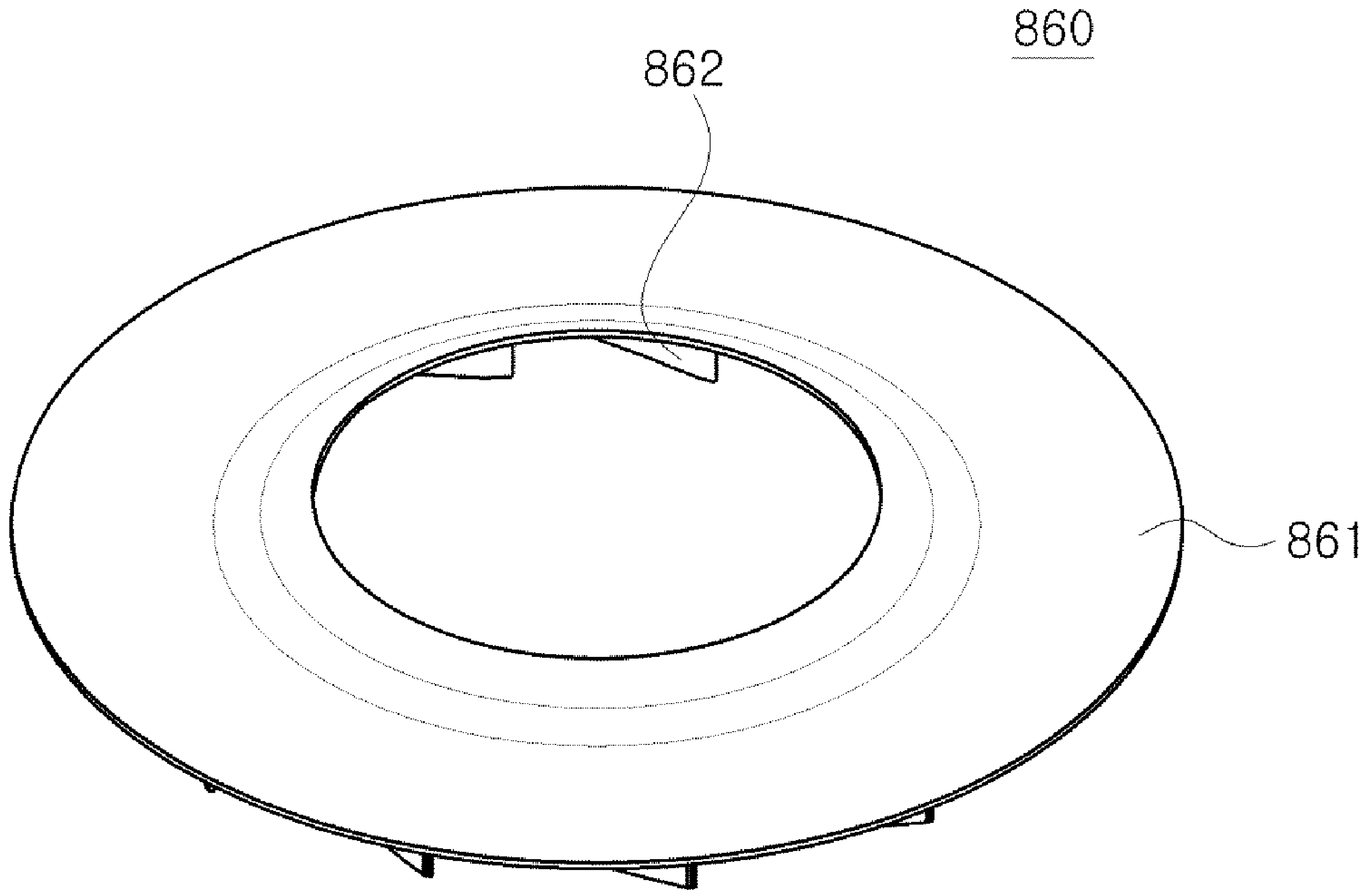


FIG.19A

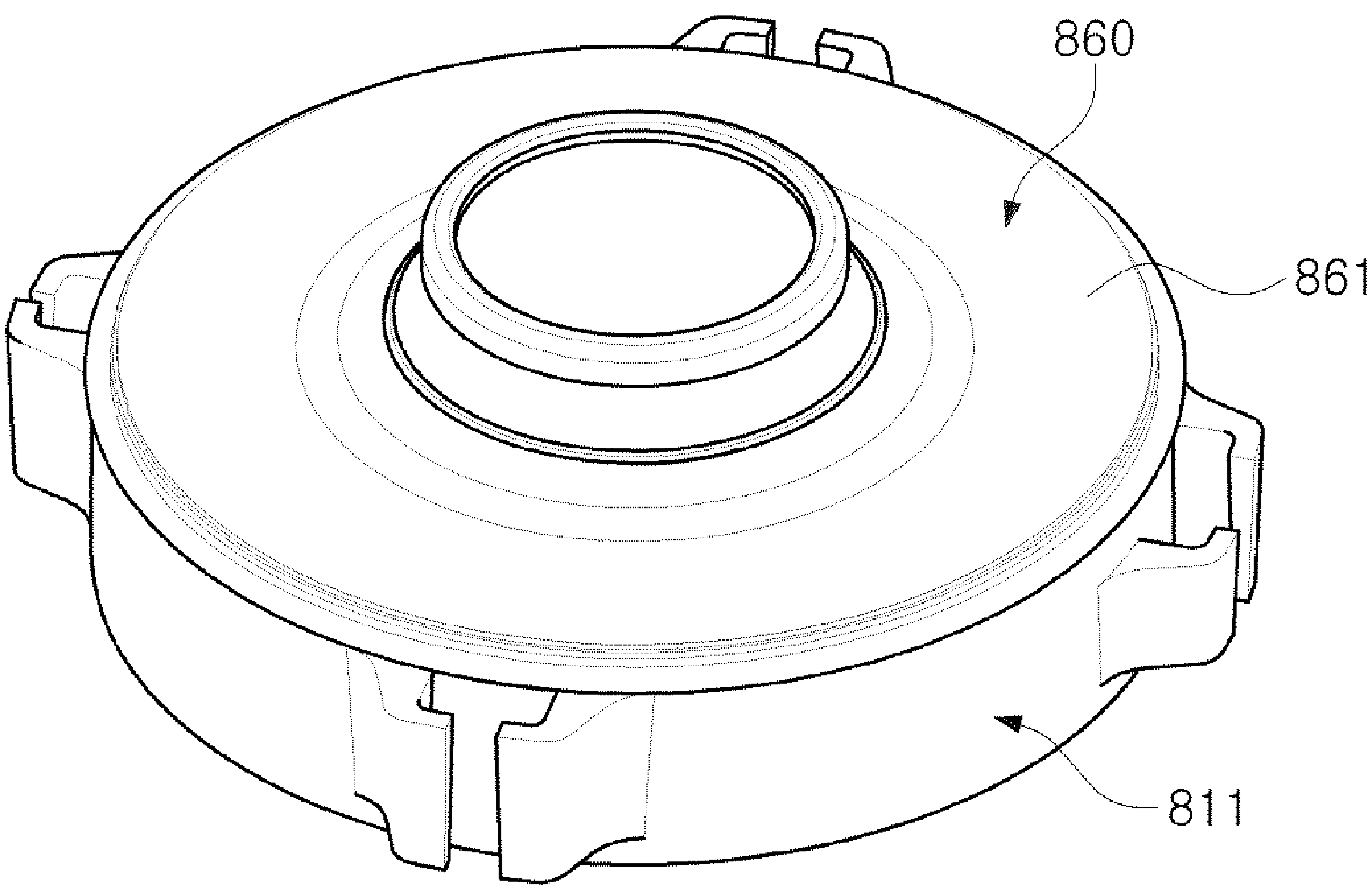
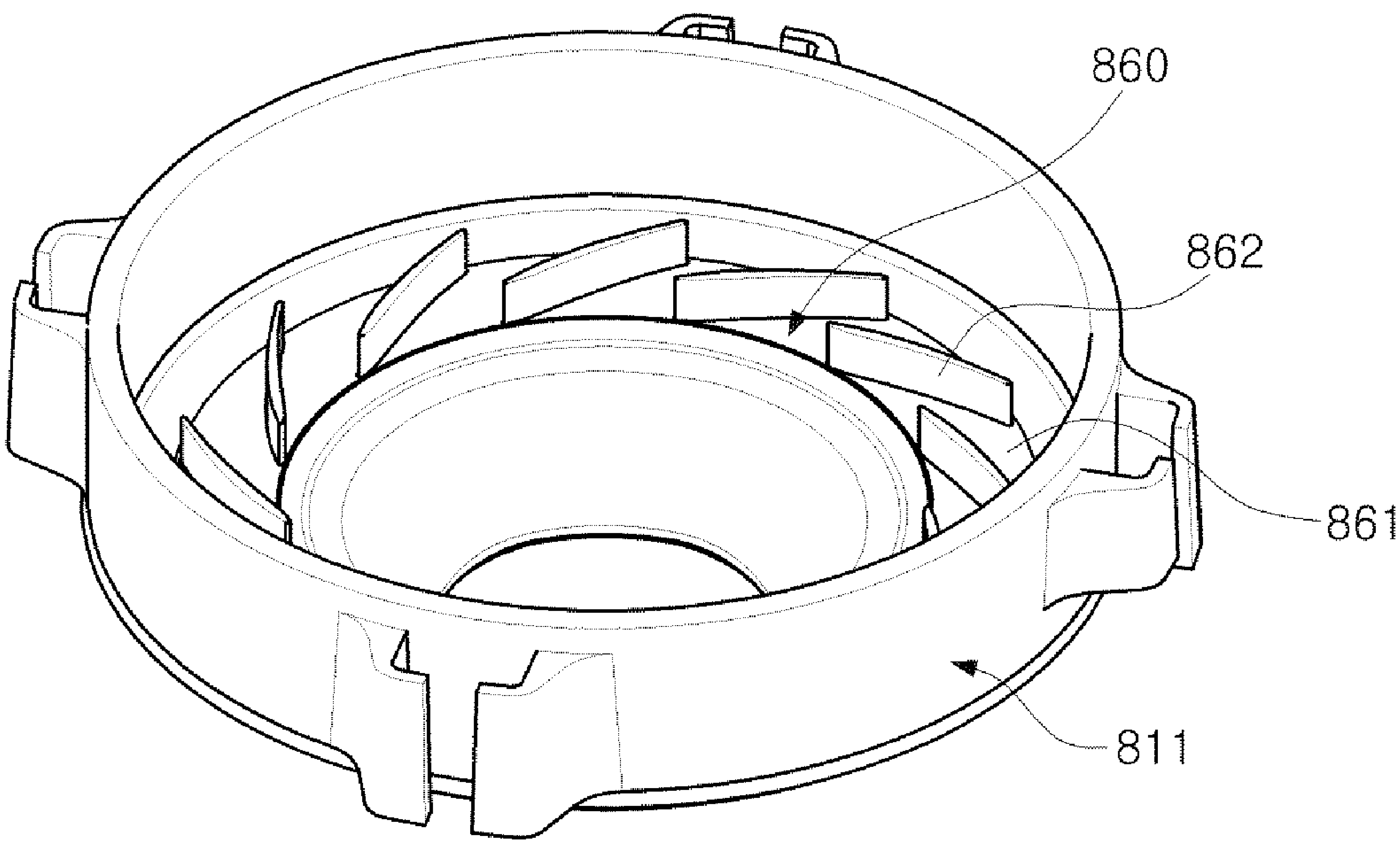


FIG.19B



VACUUM CLEANER

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the priority benefit of Korean Patent Application No. 10-2014-0103133, filed on Aug. 11, 2014 in the Korean Intellectual Property Office, the disclosure of which is incorporated herein by reference.

BACKGROUND

1. Field

Embodiments of the disclosure relate to a vacuum cleaner, and more particularly, to a vacuum cleaner having an improved structure which is capable of enhancing suction performance.

2. Description of the Related Art

In general, a cleaner refers to an apparatus which sucks air including dust on a surface to be cleaned, separates and collects the dust from the air, and then discharges purified air to an outside of a main body.

The cleaner may include an impeller and a diffuser which are structural elements determining a suction force.

The air sucked into the main body passes through the impeller and the diffuser, in turn, along a path which is bent a few times. In this process, a pressure loss of the air is increased, and thus the impeller and the diffuser are designed to have a small distance therebetween and to compensate for a reduction in the suction force due to the pressure loss. However, as the distance between the impeller and the diffuser is small, noise may be generated due to pressure perturbation. To prevent the noise, sizes of the impeller and a motor coupled to the impeller may be increased. However, in this case, since a size of the cleaner is also increased, it does not meet a recent market trend requiring a compact product.

In particular, since a small-sized cleaner such as a hand-held type cleaner may not generally use a high-power suction motor, a reduction in suction efficiency due to the pressure loss or a flow loss may be increased.

SUMMARY

Additional aspects and/or advantages will be set forth in part in the description which follows and, in part, will be apparent from the description, or may be learned by practice of the disclosure.

Therefore, it is an aspect of the disclosure to provide a vacuum cleaner having an improved structure which is capable of having a small or compact size.

It is an aspect of the disclosure to provide a vacuum cleaner having an improved structure which is capable of having a small or compact size and also enhancing a suction force.

It is an aspect of the disclosure to provide a vacuum cleaner having an improved structure which is capable of preventing noise.

It is an aspect of the disclosure to provide a vacuum cleaner having an improved structure which is capable of enhancing assemblability of a diffuser.

Additional aspects of the disclosure will be set forth in part in the description which follows and, in part, will be apparent from the description, or may be learned by practice of the disclosure.

In accordance with an aspect of the disclosure, a vacuum cleaner may include a suction unit provided in a main body, wherein the suction unit may include an impeller disposed to suck air by rotating about an axis thereof, and a diffuser disposed to guide air discharged from the impeller. The diffuser may include an inner casing, an outer casing disposed to be spaced along an outer circumference of the inner casing to form a path through which the air discharged from the impeller flows, and a plurality of vanes disposed at the inner casing to guide the air discharged from the impeller to the path, and the plurality of vanes may protrude toward the outer casing to cross at least a part of the path.

The plurality of vanes may be disposed so that one ends of the plurality of vanes are connected to the outer casing.

The diffuser may further comprise a plurality of guides disposed on the path and provided between the inner casing and the outer casing.

The plurality of guides may connect the inner casing and the outer casing.

The plurality of guides may extend in an axial direction of the impeller.

The plurality of guides may be disposed to be inclined with respect to the axial direction of the impeller.

The plurality of guides may be disposed in parallel with the axial direction of the impeller.

At least a part of the plurality of guides may include a curved surface.

The plurality of guides may be integrally formed with the plurality of vanes to be located under the plurality of vanes in the axial direction of the impeller.

The plurality of guides may include edge parts located at an upper stream side of the path in a flowing direction of the air discharged from the impeller, and the plurality of vanes may be disposed to be discontinuously located on the edge parts.

The plurality of guides may include edge parts located at an upper stream side of the path in a flowing direction of the air discharged from the impeller, and the plurality of vanes may be disposed on the edge parts to be spaced from the outer casing.

The plurality of guides may include edge parts located at an upper stream side of the path in a flowing direction of the air discharged from the impeller and configured to connect the inner casing and the outer casing, and the plurality of vanes may be disposed to be located on at least a part of the edge parts.

In accordance with an aspect of the disclosure, a vacuum cleaner may include a suction unit provided in a main body, wherein the suction unit may include an impeller disposed to suck air by rotating about an axis thereof, and a diffuser disposed to guide air discharged from the impeller. The diffuser may include an inner casing, an outer casing disposed to be spaced along an outer circumference of the inner casing, a path provided between the inner casing and the outer casing so that the air discharged from the impeller flows therethrough, and a plurality of blades formed integrally with at least one of the inner casing and the outer casing to connect the inner casing and the outer casing.

The plurality of blades may include a plurality of vanes disposed on the inner casing to extend outward in a radial direction of the inner casing.

The path may include an entrance located at an upper stream side in a flowing direction of the air discharged from the impeller, and the plurality of blades may include a plurality of vanes disposed to cross at least a part of the entrance.

The plurality of blades may include a plurality of vanes having bodies disposed between the inner casing and the outer casing in a radial direction of the inner casing, and at least one communication part may be formed at the plurality of vanes.

The at least one communication part may be formed at the bodies located on the path so that air introduced into the path passes therethrough.

The plurality of blades may include a plurality of vanes disposed on the inner casing to protrude outward in the radial direction of the inner casing, and the plurality of vanes may be gradually inclined along a rotating direction of the impeller from the inner casing toward the outer casing.

The plurality of blades may comprise a plurality of guides extended in the axial direction of the impeller to partition the path, and disposed to be coupled with at least one of the inner casing and the outer casing.

The plurality of guides may be gradually inclined along a rotating direction of the impeller from an upper stream side of the path in a flowing direction of the air discharged from the impeller to a lower stream side of the path.

The plurality of blades may include a plurality of vanes disposed on the inner casing to cross at least a part of the path in a radial direction of the inner casing, and a plurality of guides connected to the plurality of vanes so as to be disposed between the inner casing and the outer casing in the axial direction of the impeller, and at least a part of at least one side of the plurality of vanes and the plurality of guides may be formed in a curved surface.

In accordance with an aspect of the disclosure, a suction unit for a cleaning apparatus may include a housing, a motor assembly, disposed in the housing, the motor assembly including a shaft which rotates, an impeller coupled to the shaft and disposed to suck air into the suction unit; and a diffuser disposed about an outer circumference of the impeller. The diffuser may include an inner casing, an outer casing, a diffuser path formed between the inner casing and the outer casing and through which air discharged from the impeller flows, and a plurality of blades which extend from at least one of the inner casing and the outer casing toward one of the outer casing and the inner casing, to cross at least a part of the diffuser path in a radial direction of the inner casing.

The suction unit may further include an air inlet port disposed at an upper portion of the housing through which air is introduced into the housing, and an air outlet port disposed at a lower portion of the housing through which air exits the housing.

The housing may include a first housing disposed at an upper portion of the impeller, in which the air inlet port is provided, a third housing disposed at a lower portion of the impeller, in which the air outlet port is provided, and a second housing disposed between the first housing and third housing, and which is detachably coupled to and from at least one of the first housing and third housing, wherein the second housing corresponds to the outer casing of the diffuser.

The motor assembly may include an upper housing disposed at an upper portion of the shaft, the upper housing including a plurality of coupling holes, a lower housing disposed at a lower portion of the shaft, and a bearing housing to rotatably support an upper portion of the shaft, the bearing housing including a plurality of coupling grooves. The upper housing may be disposed between the diffuser and the bearing housing, and at least a part of the plurality of the blades of the diffuser may pass through the coupling holes of the upper housing to couple with the plurality of coupling grooves of the bearing housing.

The diffuser may be formed of plastic.

BRIEF DESCRIPTION OF THE DRAWINGS

These and/or other aspects of the disclosure will become apparent and more readily appreciated from the following description of the embodiments, taken in conjunction with the accompanying drawings of which:

FIG. **1** is a view illustrating a state in which a vacuum cleaner in accordance with an embodiment of the disclosure is coupled to a stick body;

FIG. **2** is a view illustrating a state in which the vacuum cleaner in accordance with an embodiment of the disclosure is separated from the stick body;

FIG. **3** is a cross-sectional view illustrating the vacuum cleaner in accordance with an embodiment of the disclosure;

FIG. **4** is a perspective view illustrating a suction unit of the vacuum cleaner in accordance with an embodiment of the disclosure;

FIG. **5** is a cross-sectional view illustrating the suction unit of the vacuum cleaner in accordance with an embodiment of the disclosure;

FIG. **6** is an exploded perspective view illustrating the suction unit of the vacuum cleaner in accordance with an embodiment of the disclosure;

FIGS. **7**A and **7**B are exploded perspective views illustrating a motor module in the suction unit of the vacuum cleaner in accordance with an embodiment of the disclosure;

FIG. **8** is a view for explaining a first embodiment of an arrangement structure of a plurality of blades in the suction unit of the vacuum cleaner in accordance with an embodiment of the disclosure;

FIG. **9** is a view for explaining a second embodiment of the arrangement structure of the plurality of blades in the suction unit of the vacuum cleaner in accordance with an embodiment of the disclosure;

FIG. **10**A is a view for explaining a third embodiment of the arrangement structure of the plurality of blades in the suction unit of the vacuum cleaner in accordance with an embodiment of the disclosure;

FIG. **10**B is an enlarged view illustrating a part of FIG. **10**A;

FIG. **11**A is a view for explaining a fourth embodiment of the arrangement structure of the plurality of blades in the suction unit of the vacuum cleaner in accordance with an embodiment of the disclosure;

FIG. **11**B is an enlarged view illustrating a part of FIG. **11**A; FIG. **12** is a view for explaining a fifth embodiment of the arrangement structure of the plurality of blades in the suction unit of the vacuum cleaner in accordance with an embodiment of the disclosure;

FIG. **13** is a perspective view illustrating a suction unit of the vacuum cleaner in accordance with an embodiment of the disclosure;

FIG. **14** is a cross-sectional view illustrating the suction unit of the vacuum cleaner in accordance with an embodiment of the disclosure;

FIG. **15** is a view illustrating a diffuser assembling process in the suction unit of the vacuum cleaner in accordance with an embodiment of the disclosure;

FIG. **16** is a view illustrating a bearing housing in the suction unit of the vacuum cleaner in accordance with an embodiment of the disclosure;

FIGS. **17**A and **17**B are views illustrating an upper housing in the suction unit of the vacuum cleaner in accordance with an embodiment of the disclosure;

FIGS. **18**A and **18**B are views illustrating the diffuser in the suction unit of the vacuum cleaner in accordance with an embodiment of the disclosure; and

FIGS. **19**A and **19**B are view illustrating a diffuser and upper housing assembly formed by an insert injection molding in the suction unit of the vacuum cleaner in accordance with an embodiment of the disclosure.

DETAILED DESCRIPTION

Reference will now be made in detail to embodiments of the disclosure, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to like elements throughout. Meanwhile, terms such as "front end", "rear end", "upper", "lower", "upper end" and "lower end" which will be used in the below description are defined based on the drawings, and a shape and a position of each element are not limited by the terms.

Suction units **200** and **200***a* in accordance with the disclosure may be applied to various types of cleaners including a canister type cleaner in which a main body and a suction nozzle are separated from each other and connected with each other through a predetermined pipe, an up-right type cleaner in which the main body and the suction nozzle are provided integrally, a hand-held type cleaner and a robot cleaner. Hereinafter, the disclosure will be described based on the hand-held type cleaner, as an example embodiment.

FIG. **1** is a view illustrating a state in which a vacuum cleaner in accordance with an embodiment of the disclosure is coupled to a stick body, FIG. **2** is a view illustrating a state in which the vacuum cleaner in accordance with an embodiment of the disclosure is separated from the stick body, and FIG. **3** is a cross-sectional view illustrating the vacuum cleaner in accordance with an embodiment of the disclosure.

As illustrated in FIGS. **1** to **3**, the vacuum cleaner **1** may include a main body **52**, a suction unit **200** and a dust collector **100**.

A grille-type first air exhaust part **56** having a plurality of air exhaust holes, a handle **62** and a power button **65** may be provided at a front surface of the main body **52**. The suction unit **200** which generates a suction force and a battery (not shown) may be installed at an inner upper side of the main body **52**. A grille-type second air exhaust part **58** having a plurality of air exhaust holes may be formed at a position opposite to the first air exhaust part **56** on a rear surface of the main body **52**. A second connection terminal **60** may be formed above the second air exhaust part **58** on the rear surface of the main body **52**. A roller **114** may be rotatably installed at a lower end of the main body **52**. A cyclone installation space (not shown) in which the cyclone type dust collector **100** is installed may be formed at a lower portion of the main body **52** so as to pass therethrough.

The dust collector **100** is not limited to the cyclone type. However, for convenience of explanation, in accordance with the following discussion the vacuum cleaner **1** includes the cyclone type dust collector **100**.

The main body **52** may include an inlet port **63**, the roller **114**, an inlet gasket (not shown), an outlet gasket (not shown) and a rib **69**. The inlet port **63** may be in close contact and coupled with an opening **4** of a stick body **14** and a cyclone entrance **110**. The inlet gasket may be installed at a circumferential surface of the inlet port **63** to prevent air from leaking through a coupling portion between the inlet port **63** and the cyclone entrance **110**. The outlet gasket may be installed around an air suction port **251** of the suction unit **200** formed above the cyclone installation space to increase a contact force between a filter unit **70** and the main body **52** and thus to prevent the air from leaking through a coupling portion therebetween.

The roller **114** may be installed under the inlet port **63**. When the vacuum cleaner **1** is used while separated from the stick body **14**, the roller **114** may be in contact with a surface to be cleaned so as to be rotated, and thus the vacuum cleaner **1** may be easily moved forward and backward, and friction between a floor surface and the vacuum cleaner **1** may be reduced.

The rib **69** may be formed to protrude from the inlet port **63**, and inserted into the opening **4** of the stick body **14**, when the vacuum cleaner **1** is installed at an installation space **3**, such that the air does not leak between the inlet port **63** and the opening **4**. Also, when the vacuum cleaner **1** is tilted and the inlet port **63** is in contact with the floor surface, the rib **69** reduces a distance between the floor surface and the inlet port **63**, and a suction force of the suction unit **200** is sufficiently transmitted to the floor surface, and thus dust sucking performance from the surface to be cleaned may be enhanced.

The dust collector **100** may include a dust container **102**, a cover member **104**, the filter unit **70** and a cyclone container **107**. The dust container **102** may be formed of a transparent material, and the filter unit **70** may be removably installed at one side thereof.

The cover member **104** may be formed of a transparent material, and may be integrally formed with the dust container **102**. When the cover member **104** is installed at the cyclone installation space (not shown) of the vacuum cleaner **1**, the cover member **104** may form an exterior of the vacuum cleaner **1**.

The cyclone container **107** may be installed at an inner side of the dust container **102** so as to partition an internal space of the dust container **102** into a centrifugal chamber S1 and a dust receiving chamber S2. A central pipe **108** may be provided at a center of the cyclone container **107**, and a spiral path guide member **106** which induces rotation of the air introduced through the cyclone entrance **110** may be installed between the cyclone container **107** and the central pipe **108**.

The vacuum cleaner **1** may be removably coupled to the stick body **14**.

The stick body **14** may be divided into a handle part **16** formed at an upper portion thereof, and a pot-shaped central part **11** formed at a lower portion thereof having the installation space **3**. The handle part **16** coupled to an upper end of the central part **11** is a part which is gripped by a user to push or pull a nozzle assembly **2**. The installation space **3** formed at the central part **11** is a space in which the vacuum cleaner **1** is able to be installed at or separated from the stick body **14**.

In FIG. **1**, a front surface of the stick body **14** is a surface when seen in an A direction, and a rear surface thereof is a surface when seen in a B direction. A main body air exhaust part **20** having a plurality of air exhaust holes may be formed at the front surface of the stick body **14**, and a main body transparent part **18** formed of a transparent panel may be formed under the main body air exhaust part **20**.

The nozzle assembly **2** may be rotatably connected to a lower end of the stick body **14**, and may be in communication with an internal air path (not shown) neck part **6** of the nozzle assembly **2** and the opening **4** of the stick body **14**. Therefore, external air and dust introduced through the nozzle assembly **2** may be introduced into the vacuum cleaner **1** through the opening **4** of the stick body **14** and the neck part **6**. A bottom inlet port **2***a* which sucks the air of the surface to be cleaned may be formed at a bottom surface of the nozzle assembly **2**, and a cylindrical brush (not shown) which rakes out the dust on the surface to be cleaned may be rotatably installed at an inner side of the nozzle assembly **2**.

The first connection terminal **12** may be provided at the installation space **3** of the stick body **14**, and a second connection terminal **60** may be installed at the rear surface of the vacuum cleaner **1**. When the vacuum cleaner **1** is installed at the installation space **3**, the first connection terminal **12** may be in contact with the second connection terminal **60**, and thus the stick body **14** may be electrically connected with the vacuum cleaner **1**.

The suction unit **200** will be described later in detail.

Hereinafter, an operation process of the vacuum cleaner **1** will be described.

A power supply to the suction unit **200** installed in the main body **52** may be switched on and off using the power button **65** installed at the main body **52**. The inlet port **63** and the roller **114** of the vacuum cleaner **1** may be in contact with the surface to be cleaned, and the external air and the dust may be sucked while the vacuum cleaner **1** is moved. When the vacuum cleaner **1** is operated, the external air may be introduced into the dust collector **100** through the inlet port **63** and the cyclone entrance **110**. Since the cyclone entrance **110** is located at a lower side, the air passing through the inlet port **63** may be directly introduced into the cyclone entrance **110** in contact with the inlet port **63**. The external air including the introduced dust may be rotated along the spiral path guide member **106**, and introduced into the centrifugal chamber S**1**, and thus the dust included in the air may be separated from the air by a centrifugal force and then stored in the dust container **102** through an upper end of the cyclone container **107**. The air from which the dust is separated may be continuously moved straight toward an upper side without a change in a moving direction and passes through the filter unit **70** installed above the cyclone container **107**. At this time, fine dust remained in the air may be removed by a grille part **71** and a filter member (not shown), and then discharged to the first and second air exhaust parts **56** and **58** of the vacuum cleaner **1** through the suction unit **200**.

When the vacuum cleaner **1** is used while installed at the stick body **14** (hereinafter, called "stick type cleaner"), the user may push a power switch (not shown) installed at the stick body **14**, may operate the stick type cleaner, may grip the handle part **16** of the stick body **14** with his or her hand, may tilt the stick body **14** with respect to the nozzle assembly **2**, and then may use the stick type cleaner **1**. The user may properly tilt the stick body **14** according to his or her physical condition (e.g., height, or other physical characteristics), and then may perform a cleaning operation while moving the stick type cleaner forward, backward, left and right. The external air including the dust may be introduced into the dust collector **100** through the nozzle assembly **2**, the neck part **6** and the opening **4** of the stick body **14**. The external air introduced into the dust collector **100** may be rotated in the centrifugal chamber S**1**, and the dust included in the external air is separated by the centrifugal force, and then stored in the dust container **102**. The air from which the dust is separated may pass through the filter unit **70** so that the fine dust is removed by the grille part **71** and the filter member (not shown), and then may be discharged to the first and second air exhaust parts **56** and **58** of the vacuum cleaner **1** through the suction unit **200**. The air discharged to the second air exhaust part **58** may be discharged to the front surface of the stick body **14** through the main body air exhaust part **20**.

FIG. **4** is a perspective view illustrating the suction unit of the vacuum cleaner in accordance with an embodiment of the disclosure, FIG. **5** is a cross-sectional view illustrating the suction unit of the vacuum cleaner in accordance with an embodiment of the disclosure, FIG. **6** is an exploded perspective view illustrating the suction unit of the vacuum cleaner in accordance with an embodiment of the disclosure, and FIGS. 7A and 7B are exploded perspective views illustrating a motor module in the suction unit of the vacuum cleaner in accordance with an embodiment of the disclosure. Hereinafter, reference numerals which are not described may correspond to those previously discussed with reference to FIGS. **1** to **3**.

The suction unit **200** may be provided at an inner side of the main body **52** to generate the suction force.

The suction unit **200** may include a housing **210** which forms an exterior thereof.

The housing **210** may have a cylindrical shape, but is not limited thereto.

The housing **210** may include a plurality of housings which are detachably coupled with each other. The housing **210** according to the disclosure may include a first housing **211**, a second housing **212** and a third housing **213**. The first housing **211**, the second housing **212** and the third housing **213** may be arranged, in turn, in an axial direction X of an impeller **220**. The first housing **211** may be arranged at an upper portion in the axial direction X of the impeller **220**, and the third housing **213** may be arranged at a lower portion in the axial direction X of the impeller **220**. The second housing **212** may be arranged between the first housing **211** and the third housing **213**.

Also the first housing **211**, the second housing **212** and the third housing **213** may be detachably coupled with each other in the axial direction X of the impeller **220**. Specifically, the first housing **211** may be detachably coupled with the second housing **212**. The second housing **212** may be detachably coupled with the first housing **211** and/or the third housing **213**. The third housing **213** may be detachably coupled with the second housing **212**.

An air inlet port **211***a* may be provided at the first housing **211** so that the air is introduced into the suction unit **200**. An air outlet port **213***a* may be provided at the third housing **213** so that the air introduced into the suction unit **200** through the air inlet port **211***a* is discharged to an outside of the suction unit **200**. In another aspect, the air inlet port **211***a* may be provided at an upper portion of the housing **210** in the axial direction X of the impeller **220**, and the air outlet port **213***a* may be provided at a lower portion of the housing **210** in the axial direction X of the impeller **220**. However, positions of the air inlet port **211***a* and the air outlet port **213***a* are not limited thereto, and may be variously changed.

An air path **230** which connects the air inlet port **211***a* with the air outlet port **213***a* may be formed at an inner side of the housing **210**.

The air path **230** may include a module path **231**, a module external path **232**, an air flowing path **233** and a diffuser path **234**. In other words, the module path **231**, the module external path **232**, the air flowing path **233** and the diffuser path **234** may be commonly called the air path **230**.

The air introduced into the suction unit **200** through the air inlet port **211***a* flows along the air path **230**. Specifically, the air introduced into the suction unit **200** through the air inlet port **211***a* may pass through the air flowing path **233** provided at the impeller **220** and then may be transmitted to the diffuser path **234**. The module path **231** and the module external path **232** may be branched from the diffuser path **234**. That is, a part of the air passing through the diffuser path **234** may flow along the module path **231**, and another part of the air passing through the diffuser path **234** may flow along the module external path **232**.

First, the module path **231** and the module external path **232** will be described.

The air introduced into the suction unit **200** through the air inlet port **211***a* flows along the air path **230**. Specifically, the air introduced into the housing **210** flows along the module path **231** which is guided to an inner side of the motor module **260** by a path guide part **241** of an insulator **240**. Further, the air introduced into the housing **210** flows along the module external path **232** formed between the motor module **260** and the housing **210**. That is, a part of the air introduced into the housing **210** flows along the module path **231**, and another part of the air introduced into the housing **210** flows along the module external path **232**. The air flowing along the module path **231** may cool heat generated from the motor module **260**. Also, the air flowing along the module path **231** and the module external path **232** may cool heat generated from a circuit board **250** while passing through the circuit board **250**.

The first housing **211** may include a shroud **211***b*.

The shroud **211***b* may be provided to correspond to the impeller **220** or the diffusers **300**, **400**, **500**, **600** and **700** (described later) and thus to guide the air introduced into the housing **210**. Specifically, the shroud **211***b* serves to guide the air introduced through the air inlet port **211***a* into the housing **210**. Further, the shroud **211***b* may have a shape corresponding to an upper portion of the impeller **220**. In other words, the shroud **211***b* may be coupled with a plurality of wings **221** of the impeller **220** to form the air flowing path **233**.

The suction unit **200** may further include the impeller **220**.

The impeller **220** may be arranged to be rotated about a shaft **222** and to suck the air. Also, the impeller **220** may be provided to be rotated with the shaft **222**. The impeller **220** may be provided at an inner side of the first housing **211**. The impeller **220** may be connected with a motor **261** to be rotated and may serve to suck the air into the suction unit **200**. The impeller **220** may be formed to suck the air in the axial direction X of the impeller **220** and to radially discharge the air. The impeller **220** may have the plurality of wings **221** which generates a flow of the air. The plurality of wings **221** may be radially formed about the shaft **222**. The air flowing path **233** may be provided between the plurality of wings **221** arranged to be spaced from each other. The air flowing path **233** may include an inflow port **233***a* which is located at an upper stream side in a flowing direction M of the air introduced through the air inlet port **211***a*, and an outflow port **233***b* which is located at a lower stream side in the flowing direction M of the air introduced through the air inlet port **211***a*. A shape and an arrangement of the impeller **220** may be variously changed, and it is sufficient as long as the air may flow.

The suction unit **200** may further include the diffusers **300**, **400**, **500**, **600** and **700**.

The diffusers **300**, **400**, **500**, **600** and **700** serve to convert kinetic energy of the air sucked into the suction unit **200** by the impeller **220** into pressure energy. In another aspect, the diffusers **300**, **400**, **500**, **600** and **700** serve to reduce a flow speed of the air flow by the impeller **220**. The diffusers **300**, **400**, **500**, **600** and **700** may be arranged to guide the air discharged from the impeller **220**. The diffusers **300**, **400**, **500**, **600** and **700** may be arranged along an outer circumference of the impeller **220** to face the outflow port **233***b* of the air flowing path **233**.

The diffusers **300**, **400**, **500**, **600** and **700** will be described later in detail.

The suction unit **200** may further include the motor module **260**.

The motor module **260** may be provided at an inner side of the housing **210**. The motor module **260** may be provided so that the motor **261** as one module is fixed to the inner side of the housing **210**.

The motor module **260** may include the motor **261** and a seating housing **790**.

The motor **261** may be installed at the inner side of the housing **210** to generate the suction force or a rotating force. The seating housing **790** may be provided so that the motor **261** is fixed to the inner side of the housing **210**.

The seating housing **790** may include a first seating housing **262** and a second seating housing **263** which is coupled with the first seating housing **262** while the motor **261** is interposed therebetween.

The first seating housing **262** may be provided to be fixed to the housing **210**.

Specifically, a seating hole **212***a* may be formed at an inner side of the second housing **212** so that the first seating housing **262** is coupled therein. The seating hole **212***a* may have a hole shape. The first seating housing **262** may be fitted into the seating hole **212***a*, but a coupling method thereof is not limited thereto.

The first seating housing **262** may include a first seating housing body **262***a*, an impeller seating part **262***b* and a first seating part **262***c*. The first seating housing body **262***a* may have a circular plate shape. The first seating housing body **262***a* may include a body coupling part **262***d* which corresponds to a shape of the seating hole **212***a* so as to be coupled to the seating hole **212***a* of the second housing **212**.

The impeller seating part **262***b* may be provided on an upper surface of the first seating housing body **262***a* so that the impeller **220** is seated thereto. An upper surface of the first seating housing body **262***a* may be formed to correspond to a shape of a rear surface of the impeller **220** and thus not to be interfered with rotation of the impeller **220** coupled to the shaft **222**.

The first seating part **262***c* may be provided at a lower surface of the first seating housing body **262***a* so that the motor **261** is seated thereto. The first seating part **262***c* may allow a stator **264** to be seated and fixed, such that a center of the shaft **222** is arranged to coincide with a rotating center of the impeller **220**.

In an embodiment of the disclosure, the first seating part **262***c* may be formed to protrude from the first seating housing body **262***a*, such that the first seating housing body **262***a* and the motor **261** are coupled so as to be spaced apart a predetermined distance from one another. However, a shape of the first seating part **262***c* is not limited thereto.

Four first seating parts **262***c* may be provided to correspond to each end of the stator **264**. However, the arrangement structure of the first seating part **262***c* is not limited thereto.

The second seating housing **263** may be provided to be coupled with the first seating housing **262**. Also, the second seating housing **263** may be provided so that the motor **261** is located between the first seating housing **262** and the second seating housing **263**.

The second seating housing **263** may include a second seating housing body **263***a* and a second seating part **263***c*. The second seating housing body **263***a* may be formed to be elongated in a lengthwise direction of the stator **264** and to correspond to a shape of the stator **264**.

Four second seating parts **263***c* may be provided to correspond to each end of the stator **264**. However, an arrangement structure of the second seating part **263***c* is not limited thereto.

The first seating housing **262** and the second seating housing **263** may be coupled with each other by a fixing member **280**. The fixing member **280** may include a screw, however the disclosure is not so limited, and may include other types of fixing members (e.g., a bolt, a pin, a rivet, an anchor, a clip, and the like). Therefore, fixing holes **280***a* and **280***b* through which the fixing member **280** is coupled may be provided at the first seating housing **262** and the second seating housing **263**, respectively.

A first through-hole **262***e* and a second through-hole **263***e* through which the shaft **222** passes may be provided at centers of the first seating housing **262** and the second seating housing **263**, respectively. A first bearing **283** and a second bearing **284** may be respectively arranged at the first through-hole **262***e* and the second through-hole **263***e* to support rotation of the shaft **222**.

The first seating housing **262** may include a first seating protrusion **262***f* and the first seating part **262***c*.

The first seating part **262***c* may be provided at an inner side of the first seating housing **262**. Also, the first seating part **262***c* may be provided so that one side surface of the motor **261** is seated thereto. The first through-hole **262***e* may be formed at centers of a plurality of first seating parts **262***c* so that centers of a rotor **265**, the impeller **220** and the diffusers **300**, **400**, **500**, **600** and **700** coincide with each other, while the stator **264** is seated or fixed to the first seating part **262***c*.

The first seating protrusion **262***f* may be formed to protrude from the first seating housing body **262***a* along a circumference of the first seating part **262***c*. Also, the first seating protrusion **262***f* may be provided so that the motor **261** is covered by an inner surface of the first seating protrusion **262***f*. When the suction unit **200** is operated, the first seating protrusion **262***f* prevents a position of the motor **261** from being twisted in a direction vertical to the shaft **222**. Specifically, an upper surface of the motor **261** is seated to the first seating part **262***c*, and the side surface of the motor **261** is seated to a first protrusion seating surface **262***h* of the first seating protrusion **262***f*. A first guide surface **262***g* may be formed at the first seating protrusion **262***f* to guide the motor **261** and thus to allow the motor **261** to be easily seated to the first seating part **262***c*. The first guide surface **262***g* may be provided at an end of the first seating protrusion **262***f* and may be formed to be inclined inward at a predetermined angle. Further, the first guide surface **262***g* may be provided to be connected with the first protrusion seating surface **262***h*.

The first seating housing body **262***a* may be formed in a circular shape. For example, four first seating protrusions **262***f* may be arranged to protrude from the first seating housing body **262***a*. However, the disclosure is not so limited and the first seating housing body **262***a* may include more than or less than four first seating protrusions **262***f*.

The second seating housing **263** may include a second seating protrusion **263***f* and the second seating part **263***c*.

The second seating part **263***c* may be provided at an inner side of the second seating housing **263** so that another side surface of the motor **261** is seated thereto. The second through-hole **263***e* may be formed at centers of a plurality of second seating parts **263***c* so that centers of a rotor **265**, the impeller **220** and the diffusers **300**, **400**, **500**, **600** and **700** coincide with each other, while the stator **264** is seated or fixed to the first seating part **262***c*.

The second seating protrusion **263***f* may be formed to protrude from the second seating housing body **263***a* along a circumference of the second seating part **263***c*. Also, the second seating protrusion **263***f* may be provided so that the motor **261** is covered by an inner surface of the second seating protrusion **263***f*. When the suction unit **200** is operated, the first seating protrusion **262***f* and the second seating protrusion **263***f* prevents the position of the motor **261** from being twisted in the direction vertical to the shaft **222**.

A second guide surface **263***g* formed to be inclined at a predetermined angle may be formed at an inner side of the second seating protrusion **263***f* to allow the motor **261** to be easily seated to the second seating part **263***c*, when the motor **261** is coupled with the second seating protrusion **263***f*. Specifically, a lower surface of the motor **261** may be seated to the second seating part **263***c*. The side surface of the motor **261** may be seated to a second protrusion seating surface **263***h* of the second seating protrusion **263***f*. The second guide surface **263***g* may be formed at the second seating protrusion **263***f* to guide the motor **261** and thus to allow the motor **261** to be easily seated to the second seating part **263***c*. The second guide surface **263***g* may be provided at an end of the second seating protrusion **263***f* and may be formed to be inclined at the predetermined angle. Further, the second guide surface **263***g* may be provided to be connected with the second protrusion seating surface **263***h*.

The second seating housing body **263***a* may be formed to be elongated in the lengthwise direction of the stator **264** and to correspond to the shape of the stator **264**. For example, four second seating protrusions **263***f* may be provided at positions corresponding to the first seating protrusions **262***f* of the first seating housing **262**. However, the disclosure is not so limited and the second seating housing body **263***a* may include more than or less than four second seating protrusions **263***f*.

A sensor magnet **293** may be coupled to a lower portion of the shaft **222**.

The sensor magnet **293** may be magnetized at the same time with a magnet (not shown) provided at the rotor **265** and may have the same magnetization direction as the magnet of the rotor **265**. The sensor magnet **293** may be provided on the same axis as the magnet of the rotor **265**, and a hole sensor **290** may sense a magnetic field of the sensor magnet **293** and may grasp a position of the rotor **265** according to the rotation. Therefore, the position of the rotor **265** may be controlled. The hole sensor **290** may be arranged to be seated to a sensor bracket **291**. One end of the sensor bracket **291** may be coupled to a sensor seating part **292** provided at a rear surface of the second seating housing **263**. The other end of the sensor bracket **291** may be coupled to the circuit board **250**.

The first seating housing **262** and the second seating housing **263** may be coupled by the fixing member **280**. Therefore, the fixing holes **280***a* and **280***b* through which the fixing member **280** is coupled may be provided at the first seating housing **262** and the second seating housing **263**, respectively.

FIG. **8** is a view for explaining an embodiment of an arrangement structure of the plurality of blades in the suction unit of the vacuum cleaner in accordance with an embodiment of the disclosure. Hereinafter, reference numerals which are not described may correspond to those previously discussed with reference to FIGS. **1** to 7B. Hereinafter, a path may have the same meaning as or correspond to the diffuser path **234**. Also, the second housing **212** may have the same meaning as or correspond to each outer casing **212** of the diffusers **300**, **400**, **500**, **600** and **700**.

The diffusers **300**, **400**, **500**, **600** and **700** may include casings **212** and **310**.

The casings **212** and **310** may include an inner casing **310** and an outer casing **212**.

The outer casing **212** may be located at an outer side in a radial direction D of the inner casing **310**.

The outer casing **212** may be arranged along an outer circumference of the inner casing **310**.

The outer casing **212** may be arranged to be spaced apart from the inner casing **310**.

The outer casing **212** may be arranged along the outer circumference of the inner casing **310** to be spaced therefrom.

The inner casing **310** and the outer casing **212** may be integrally formed.

The inner casing **310** may include the seating hole **212***a* and a frame **311**. The seating hole **212***a* may be formed at a center portion of the inner casing so that the first seating housing **262** is coupled thereto. The seating hole **212***a* may have the hole shape, but the shape of the seating hole **212***a* is not limited thereto. The impeller **220** may be seated to the impeller seating part **262***b* of the first seating housing **262** in the seating hole **212***a*. The frame **311** may be provided at an outside of the seating hole **212***a*. The frame **311** may be arranged along a circumference of the seating hole **212***a*. In other words, the frame **311** may define a boundary of the seating hole **212***a*. The frame **311** may be formed to have a predetermined width in the radial direction D of the inner casing **310**.

The diffusers **300**, **400**, **500**, **600** and **700** may further include the diffuser path **234**.

The diffuser path **234** may be formed at an inner side of the casings **212** and **310**. Specifically, the diffuser path **234** may be provided between the inner casing **310** and the outer casing **212** so that the air passing through the air flowing path **233** flows therethrough. The diffuser path **234** may be arranged adjacent to the air flowing path **233**. In other words, the diffuser path **234** may be arranged adjacent to the outflow port **233***b* of the air flowing path **233**. Alternatively, the diffuser path **234** may be connected with the air flowing path **233**. The diffuser path **234** may be directly or indirectly connected with the air flowing path **233**.

The diffuser path **234** may include an entrance **234***a* which is located at an upper stream side in a flowing direction M of the air discharged from the impeller **220** and an exit **234***b* which is located at a lower stream side in the flowing direction M of the air discharged from the impeller **220**. That is, the entrance **234***a* may be located at an upper stream side in a flowing direction M of the air passing through the air flowing path **233**, and the exit **234***b* may be located at a lower stream side in the flowing direction M of the air passing through the air flowing path **233**.

The diffusers **300**, **400**, **500**, **600** and **700** may further include a plurality of blades **320**, **420**, **520**, **620** and **720**.

The plurality of blades **320**, **420**, **520**, **620** and **720** may be arranged between the inner casing **310** and the outer casing **212** to guide the air discharged from the impeller **220**.

The plurality of blades **320**, **420**, **520**, **620** and **720** may connect the inner casing **310** with the outer casing **212**.

The plurality of blades **320**, **420**, **520**, **620** and **720** may be integrally formed with at least one of the inner casing **310** and the outer casing **212**.

The plurality of blades **320**, **420**, **520**, **620** and **720** may be integrally formed with at least one of the inner casing **310** and the outer casing **212** to connect the inner casing **310** with the outer casing **212**.

The plurality of blades **320**, **420**, **520**, **620** and **720** may be radially arranged toward an outside in the radial direction D of the inner casing **310**.

The plurality of blades **320**, **420**, **520**, **620** and **720** may be installed at the inner casing **310** to extend toward the outer casing **212**. That is, the plurality of blades **320**, **420**, **520**, **620** and **720** may be installed at the inner casing **310** to extend toward the outer casing **212** outward in the radial direction D of the inner casing **310**.

Alternatively, the plurality of blades **320**, **420**, **520**, **620** and **720** may be installed at the outer casing **212** to extend toward the inner casing **310**. That is, the plurality of blades **320**, **420**, **520**, **620** and **720** may be installed at the outer casing **212** to extend toward the inner casing **310** inward in the radial direction D of the inner casing **310**.

The plurality of blades **320**, **420**, **520**, **620** and **720** may further include a plurality of vanes **421**, **521**, **621** and **721** and a plurality of guides **422**, **522** and **622**.

The plurality of vanes **421**, **521**, **621** and **721** and the plurality of guides **422**, **522** and **622** may be formed integrally.

Alternatively, the plurality of vanes **421**, **521**, **621** and **721** and the plurality of guides **422**, **522** and **622** may be assembled with or coupled to each other.

Alternatively, the plurality of vanes **421**, **521**, **621** and **721** and the plurality of guides **422**, **522** and **622** may be spaced apart from each other.

The plurality of vanes **421**, **521**, **621** and **721** and the plurality of guides **422**, **522** and **622** may be arranged to face each other in the axial direction X of the impeller **220**. Specifically, the plurality of vanes **421**, **521**, **621** and **721** may be located above the plurality of guides **422**, **522** and **622** in the axial direction X of the impeller **220**, and the plurality of guides **422**, **522** and **622** may be located under the plurality of vanes **421**, **521**, **621** and **721** in the axial direction X of the impeller **220**.

The plurality of vanes **421**, **521**, **621** and **721** may be disposed at at least one of the inner casing **310** and the outer casing **212**.

The plurality of vanes **421**, **521**, **621** and **721** may be disposed at the inner casing **310**. The plurality of vanes **421**, **521**, **621** and **721** may be provided on the inner casing **310** to face the outflow port **233***b* of the air flowing path **233**. Also, the plurality of vanes **421**, **521**, **621** and **721** may be provided on the inner casing **310** to extend outward in the radial direction D of the inner casing **310**. Specifically, the plurality of vanes **421**, **521**, **621** and **721** may be provided on the frame **311** of the inner casing **310** to extend outward in the radial direction D of the inner casing **310**.

The plurality of vanes **421**, **521**, **621** and **721** may be disposed at the outer casing **212**. The plurality of vanes **421**, **521**, **621** and **721** may be disposed on the outer casing **212** to extend inward in the radial direction D of the inner casing **310**. The plurality of vanes **421**, **521**, **621** and **721** may extend toward the inner casing **310** to face the outflow port **233***b* of the air flowing path **233**.

The plurality of vanes **421**, **521**, **621** and **721** may be disposed at the inner casing **310** and the outer casing **212**. The plurality of vanes **421**, **521**, **621** and **721** may be disposed on the inner casing **310** and the outer casing **212** to connect the inner casing **310** with the outer casing **212**. Alternatively, the plurality of vanes **421**, **521**, **621** and **721** may be discontinuously disposed at the inner casing **310** and the outer casing **212**.

Like this, the plurality of vanes **421**, **521**, **621** and **721** may be disposed at at least one of the inner casing **310** and the outer casing **212** to extend outward in the radial direction

D of the inner casing **310**, and thus the air path **230** through which the air introduced through the air inlet port **211***a* flows, particularly, the air flowing path **233** or the diffuser path **234** may secure a sufficient length. Therefore, an improvement effect of suction performance of the suction unit **200** may be expected.

The plurality of vanes **421**, **521**, **621** and **721** may be disposed on the inner casing **310** to protrude toward the outer casing **212**. The plurality of vanes **421**, **521**, **621** and **721** may be disposed on the frame **311** to protrude toward the outer casing **212**. However, the arrangement structure of the plurality of vanes **421**, **521**, **621** and **721** is not limited thereto, and the plurality of vanes **421**, **521**, **621** and **721** may be disposed on the outer casing **212** to protrude toward the inner casing **310**.

The plurality of vanes **421**, **521**, **621** and **721** may be provided to cross at least a part of the diffuser path **234**. The plurality of vanes **421**, **521**, **621** and **721** may be provided to cross at least a part of the diffuser path **234** in the radial direction D of the inner casing **310**. The plurality of vanes **421**, **521**, **621** and **721** may be provided to cross at least a part of the entrance **234***a*.

The plurality of vanes **421**, **521**, **621** and **721** may be disposed at at least one of the inner casing **310** and the outer casing **212** to be inclined with respect to the radial direction D of the inner casing **310**. Specifically, the plurality of vanes **421**, **521**, **621** and **721** may be disposed at at least one of the inner casing **310** and the outer casing **212** to be inclined along a rotating direction R of the impeller **220** with respect to the radial direction D of the inner casing **310**. In other words, the plurality of vanes **421**, **521**, **621** and **721** may be disposed at at least one of the inner casing **310** and the outer casing **212** to be gradually inclined from the inner casing **310** toward the outer casing **212**.

The plurality of vanes **421**, **521**, **621** and **721** may connect the air flowing path **233** and the diffuser path **234**.

The plurality of guides **422**, **522** and **622** may be disposed on the diffuser path **234**.

The plurality of guides **422**, **522** and **622** may be disposed to be coupled with at least one of the inner casing **310** and the outer casing **212**.

The plurality of guides **422**, **522** and **622** may connect the inner casing **310** and the outer casing **212**. The plurality of guides **422**, **522** and **622** may directly or indirectly connect the inner casing **310** and the outer casing **212**.

The plurality of guides **422**, **522** and **622** may be disposed between the inner casing **310** and the outer casing **212**. That is, the plurality of guides **422**, **522** and **622** may be disposed between the inner casing **310** and the outer casing **212** to partition the diffuser path **234**.

The plurality of guides **422**, **522** and **622** may extend along in the axial direction X of the impeller **220**.

The plurality of guides **422**, **522** and **622** may include an edge part **323** (referring to FIG. **6**) which is located at an upper stream side of the diffuser path **234** in a flowing direction M of the air discharged from the impeller **220**. The edge part **323** may be formed at one ends of the plurality of guides **422**, **522** and **622** to face the entrance **234***a* of the diffuser path **234**. The edge part **323** may connect the inner casing **310** and the outer casing **212**. That is, the edge part **323** may connect the inner casing **310** and the outer casing **212**, and may be formed at one ends of the plurality of guides **422**, **522** and **622** facing the entrance **234***a* of the diffuser path **234**. The plurality of vanes **421**, **521**, **621** and **721** may be formed above the edge parts **323** of the plurality of guides **422**, **522** and **622**. In other words, the plurality of vanes **421**, **521**, **621** and **721** may be disposed to be located on at least a part of the edge parts **323** of the plurality of guides **422**, **522** and **622**.

The plurality of guides **422**, **522** and **622** may be formed to be inclined with respect to the axial direction X of the impeller **220**. Specifically, the plurality of guides **422**, **522** and **622** may be formed to be gradually inclined along the rotating direction R of the impeller R from the upper stream side of the diffuser path **234** in the flowing direction M of the air discharged from the impeller **220** toward the lower stream side of the diffuser path **234**. That is, the plurality of guides **422**, **522** and **622** may be formed to be gradually inclined along the rotating direction R of the impeller **220** from the entrance **234***a* of the diffuser path **234** in the flowing direction M of the air discharged from the impeller **220** toward the exit **234***b* of the diffuser path **234**.

The plurality of blades **320**, **420**, **520**, **620** and **720** may include a curved surface. At least a part of at least one side of the plurality of vanes **421**, **521**, **621** and **721** and the plurality of guides **422**, **522** and **622** may include the curved surface.

Hereinafter, as illustrated in FIG. **8**, an arrangement structure of the plurality of blades **320** in accordance with an embodiment of the disclosure will be described in detail.

The plurality of blades **320** may connect the inner casing **310** and the outer casing **212**.

The plurality of vanes (not shown) may be located above the plurality of guides (not shown) in the axial direction X of the impeller **220**, and the plurality of guides (not shown) may be located under the plurality of vanes (not shown) in the axial direction X of the impeller **220**. In other words, the plurality of vanes (not shown) may be located on the edge parts **323** of the plurality of guides (not shown).

The plurality of vanes (not shown) and the plurality of guides (not shown) may be integrally formed. Specifically, the plurality of vanes (not shown) may be integrally formed with the plurality of guides (not shown) to be located on the edge parts **323**.

The plurality of vanes (not shown) may be disposed at at least one of the inner casing **310** and the outer casing **212** to protrude upward in the axial direction X of the impeller **220**. The plurality of vanes (not shown) may protrude upward in the axial direction X of the impeller **220** to face the shroud **211***b* of the first housing **211**.

The plurality of vanes (not shown) may be installed on the frame **311** of the inner casing **310**. That is, the plurality of vanes (not shown) may be installed on the frame **311** of the inner casing **310** to extend outward in the radial direction D of the inner casing **310**.

The plurality of vanes (not shown) may be disposed to cross the entrance **234***a* of the diffuser path **234** outward in the radial direction D of the inner casing **310**.

The plurality of vanes (not shown) may be disposed so that one ends of the plurality of vanes (not shown) are connected with the outer casing **212**. That is, one ends of the plurality of vanes (not shown) may be connected to the outer casing **212**, and the other ends of the plurality of vanes (not shown) may be connected to the frame **311** of the inner casing **310**.

The plurality of guides (not shown) may be disposed in parallel with the axial direction X of the impeller **220**.

FIG. **9** is a view for explaining an embodiment of the arrangement structure of the plurality of blades in the suction unit of the vacuum cleaner in accordance with an embodiment of the disclosure. Hereinafter, reference numerals which are not described may correspond to those previously discussed with reference to FIGS. **1** to **8**. Also, matters already described with reference to FIG. **8** may be omitted for the sake of brevity.

As illustrated in FIG. **9**, the plurality of blades **420** may connect the inner casing **310** and the outer casing **212**.

The plurality of vanes **421** may be located above the plurality of guides **422** in the axial direction X of the impeller **220**, and the plurality of guides **422** may be located under the plurality of vanes **421** in the axial direction X of the impeller **220**. In other words, the plurality of vanes **421** may be located on the edge parts **323** of the plurality of guides **422**.

The plurality of vanes **421** may be integrally formed with the plurality of guides **422** to be located on the edge parts **323**.

The plurality of vanes **421** may be disposed at at least one of the inner casing **310** and the outer casing **212** to protrude upward in the axial direction X of the impeller **220**.

The plurality of vanes **421** may be installed on the frame **311** of the inner casing **310** to extend outward in the radial direction D of the inner casing **310**.

One ends of the plurality of vanes **421** may be connected to the outer casing **212**, and the other ends of the plurality of vanes **421** may be connected to the frame **311** of the inner casing **310**.

At least a part of the plurality of vanes **421** may include a curved surface.

The plurality of guides **422** may be disposed to be inclined with respect to the axial direction X of the impeller **220**. Specifically, the plurality of guides **422** may be disposed to be gradually inclined along the rotating direction R of the impeller **220** from the entrance **234***a* of the diffuser path **234** in the flowing direction M of the air discharged from the impeller **220** toward the exit **234***b* of the diffuser path **234**. Since the plurality of guides **422** are disposed to be inclined with respect to the axial direction X of the impeller **220**, the air introduced into the diffuser path **234** through the entrance **234***a* may flow more smoothly.

At least a part of the plurality of guides **422** may include the curved surface. As an example, at least a part of the plurality of guides **422** may include a concavely or convexly curved surface in the axial direction X of the impeller **220**.

FIG. **10**A is a view for explaining an embodiment of the arrangement structure of the plurality of blades in the suction unit of the vacuum cleaner in accordance with an embodiment of the disclosure, and FIG. **10**B is an enlarged view illustrating a part of FIG. **10**A. Hereinafter, reference numerals which are not described may correspond to those previously discussed with reference to FIGS. **1** to **8**. Also, matters already described with reference to FIG. **8** may be omitted for the sake of brevity.

As illustrated in FIGS. **10**A and **10**B, the plurality of blades **520** may be provided between the inner casing **310** and the outer casing **212**.

The plurality of vanes **521** may be located on the edge parts **323** of the plurality of guides **522** in the axial direction X of the impeller **220**.

The plurality of vanes **521** may be integrally formed with the plurality of guides **522** to be located on the edge parts **323**, for example, to have a substantially stepped-shaped appearance.

The plurality of vanes **521** may protrude upward in the axial direction X of the impeller **220** to face the shroud **211***b* of the first housing **211**.

The plurality of vanes **521** may be disposed at at least one of the inner casing **310** and the outer casing **212**.

The plurality of vanes **521** may be installed on the frame of the inner casing **310** to extend outward in the radial direction D of the inner casing **310**.

The plurality of vanes **521** may include bodies **321***c* disposed between the inner casing **310** and the outer casing **212** in the radial direction D of the inner casing **310**. The bodies **321***c* may be located on the edge part **323**. Also, the bodies **321***c* may have a shape corresponding to the edge parts **323**, but is not limited thereto.

The plurality of vanes **521** may be disposed to be spaced apart from the outer casing **212**. That is, one ends of the plurality of vanes **521** facing the outside in the radial direction D of the inner casing **310** may be disposed to be spaced apart from the outer casing **212**. The plurality of vanes **521** may be disposed on the edge parts **323** to be spaced apart from the outer casing **212**.

Also, the plurality of vanes **521** may further include at least one communication part **330**. The at least one communication part **330** may be formed at the plurality of vanes **521** located on the diffuser path **234**, such that the air introduced into the diffuser path **234** passes therethrough. The at least one communication part **330** may be formed at the bodies **321***c*. That is, the at least one communication part **330** may be formed at the bodies **321***c* located on the diffuser path **234**. The at least one communication part **330** may be formed at one ends of the plurality of vanes **521** which face the outside in the radial direction D of the inner casing **310** so that the plurality of vanes **521** are spaced apart from the outer casing **212**. The at least one communication part **330** may have a hole shape, but is not limited thereto. The at least one communication part **330** may relieve a pressure of the air acting on at least one side of the plurality of vanes **521** and the plurality guides **522**, and thus may enhance the suction performance of the suction unit **200**. Also, the at least one communication part **330** may reduce noise generated from the suction unit **200**.

At least a part of the plurality of vanes **521** may include a curved surface.

At least a part of the plurality of guides **522** may include the curved surface.

The plurality of guides **522** may be disposed to be gradually inclined along the rotating direction R of the impeller **220** from the entrance **234***a* of the diffuser path **234** in the flowing direction M of the air discharged from the impeller **220** toward the exit **234***b* of the diffuser path **234**.

FIG. **11**A is a view for explaining an embodiment of the arrangement structure of the plurality of blades in the suction unit of the vacuum cleaner in accordance with an embodiment of the disclosure, and FIG. **11**B is an enlarged view illustrating a part of FIG. **11**A. Hereinafter, reference numerals which are not described may correspond to those previously discussed with reference to FIGS. **1** to **10**B. Also, matters already described with reference to FIGS. **10**A and **10**B may be omitted for the sake of brevity.

As illustrated in FIGS. **11**A and **11**B, the plurality of vanes **621** may be discontinuously disposed above the plurality of guides **622**, for example, to have a substantially square wave shaped appearance. That is, the plurality of vanes may be disposed to be discontinuously located on the edge parts **323**. In another aspect, at least one communication part **330** may be formed at inner sides of the bodies **321***c*.

When the plurality of vanes **621** are discontinuously disposed, the plurality of vanes **621** may include inner vanes **621***b* disposed at the inner casing **310** and outer vanes **621***a* disposed at the outer casing **212**. The inner vanes **621***b* and the outer vanes **621***a* may face each other while the diffuser path **234** is interposed therebetween. In other words, the inner vanes **621***b* and the outer vanes **621***a* may be spaced apart from each other while the diffuser path **234** is interposed therebetween. The inner vanes **621***b* may be disposed on the frame **311** of the inner casing **310**.

FIG. **12** is a view for explaining an embodiment of the arrangement structure of the plurality of blades in the suction unit of the vacuum cleaner in accordance with an embodiment of the disclosure. Hereinafter, reference numerals which are not described may correspond to those previously discussed with reference to FIGS. **1** to **11**B. Also, matters already described with reference to FIG. **8** may be omitted for the sake of brevity.

As illustrated in FIG. **12**, the plurality of blades **720** may include the plurality of vanes **721** and a plurality of bridges **340**.

The plurality of bridges **340** may connect the inner casing **310** and the outer casing **212**. Specifically, one ends of the plurality of bridges **340** may be connected to the inner casing **310** and the other ends of the plurality of bridges **340** may be connected to the outer casing **212**. The plurality of bridges **340** may be provided between the inner casing **310** and the outer casing **212** and may serve to partition the diffuser path **234**. The plurality of bridges **340** may be disposed along the circumference of the inner casing **310** to be spaced apart from each other.

The plurality of vanes **721** may be installed on the frame **311** of the inner casing **310**. Specifically, the plurality of vanes **721** may be disposed on the frame **311** of the inner casing **310** to extend outward in the radial direction D of the inner casing **310**. The plurality of vanes **721** may be disposed on the frame **311** to be located between the plurality of bridges **340** spaced apart from each other. That is, one ends of the plurality of vanes **721** facing outward in the radial direction D of the inner casing **310** may be located between the plurality of bridges **340** spaced from each other. However, the arrangement structure of the plurality of vanes **721** is not limited thereto, and the one ends of the plurality of vanes **721** facing outward in the radial direction D of the inner casing **310** may be located on the plurality of bridges **340**.

The plurality of bridges **340** may be integrally formed with the inner casing **310** and the outer casing **212**.

The plurality of vanes **721** may be integrally formed with at least one of the inner casing **310** and the outer casing **212**.

The plurality of vanes **721** may be disposed to extend outward in the radial direction D of the inner casing **310**. The plurality of vanes **721** may connect the air flowing path **233** and the diffuser path **234**.

The shapes of the plurality of vanes **421**, **521**, **621** and **721** may be applied regardless of a kind of the motor. That is, FIGS. **1** to **12** have been described centering on a DC motor, but also may be applied to a BLDC motor, an AC motor or the like.

FIG. **13** is a perspective view illustrating a suction unit of the vacuum cleaner in accordance with an embodiment of the disclosure, and FIG. **14** is a cross-sectional view illustrating the suction unit of the vacuum cleaner in accordance with an embodiment of the disclosure.

As illustrated in FIGS. **13** and **14**, the suction unit **200***a* may include a motor assembly **800** and a controller assembly **900**.

The motor assembly **800** may include a housing **810**.

The housing **810** may form an exterior of the motor assembly **800**.

The housing **810** may include an upper housing **811** which is located at an upper portion in an axial direction P of a motor shaft **831**, and a lower housing **812** which is located at a lower portion in the axial direction P of the motor shaft **831**. The upper housing **811** and the lower housing **812** may be coupled with each other to be detachable in the axial direction P of the motor shaft **831**.

The upper housing **811** may include a shroud **811***a*.

The shroud **811***a* may be provided to correspond to an impeller **850** and thus to guide the air introduced into the suction unit **200***a*. The air introduced through an air inflow port **813** flows along an air path **815**, and is discharged to an air outflow port **814** through the shroud **811***a*.

The air outflow port **814** may be provided at the lower housing **812**. The air outflow port **814** may be provided at the lower housing **812** so that the air introduced through the air inflow port **813** is discharged therethrough.

A stator **820** and a rotor **830** may be disposed in the housing **810**. The rotor **830** may be provided to be rotated by an electromagnetic interaction with the stator **820**. The rotor **830** may be disposed in the stator **820**.

The motor shaft **831** may be inserted into a center of the rotor **830** to be rotated with the rotor **830**. One side of the motor shaft **831** may be rotatably supported by a bearing housing **840** via a first bearing **832**, and the other side of the motor shaft **831** may be rotatably supported by the lower housing **812** via a second bearing **833**.

The stator **820** may include a stator body **821**, a first insulator **822**, a second insulator **823** and a coil (not shown).

A rotor accommodating part (not shown) which accommodates the rotor **830** may be formed at a center portion of the stator body **821**. The stator body **821** may be formed by stacking pressed steel plates.

A balancer **834** may be provided at the motor shaft **831**. The balancer **834** serves to prevent the motor shaft **831** from being eccentrically rotated. The balancer **834** and the rotor **830** may be disposed up and down in the axial direction P of the motor shaft **831**. Specifically, the balancer **834** may include a first balancer **834***a* disposed at an upper side of the rotor **830** in the axial direction P of the motor shaft **831** to prevent the eccentric rotation of the rotor **830**, and a second balancer **834***b* disposed at a lower side of the rotor **830** in the axial direction P of the motor shaft **831**. By such a structure, a center of mass of the rotor **830** at upper and lower sides of the motor shaft **831** centering on the rotor **830** may be close to the motor shaft **831**, and thus the eccentric rotation of the motor shaft **831** and the rotor **830** may be prevented. However, a method of preventing the eccentric rotation of the motor shaft **831** and the rotor **830** is not limited thereto.

The motor assembly **800** may further include the impeller **850** and a diffuser **860**.

The impeller **850** may be provided to be rotated with the motor shaft **831**. The impeller **850** may be provided so that the air introduced in the axial direction P of the motor shaft **831** is discharged in a radial direction of the motor shaft **831** according to rotation of the impeller **850**. That is, the impeller **850** may include a centrifugal fan. The impeller **850** may have a plurality of wings **851** which generate a flow of the air. A fixing member **852** which fixes the impeller **850** to prevent the impeller **850** from being separated may be provided at one end of the motor shaft **831**. The shape and arrangement of the impeller **850** are not limited thereto.

The diffuser **860** serves to convert kinetic energy of the air sucked into the suction unit **200***a* into pressure energy by the impeller **850**. In another aspect, the diffuser **860** serves to reduce a flow speed of the air flowing by the impeller **220**. The diffuser **860** may be disposed to guide the air discharged from the impeller **850**. The detailed shape and structure of the diffuser **860** will be described later.

The controller assembly **900** may be provided to control the motor assembly **800**. The controller assembly **900** may be provided to be disposed at one side of the motor assembly **800**.

The controller assembly **900** may include a controller housing **910** and a printed circuit board **920** which is provided in the controller housing **910**.

The controller housing **910** may be provided to protect the printed circuit board **920** or a reactor **930** disposed therein. The air inflow port **813** through which the air is introduced may be provided at the controller housing **910**. The air inflow port **813** may be provided to be in communication with the air path **815**. The air inflow port **813** may be provided at the controller housing **910** to be located on the axial direction P of the motor shaft **831**, but a position of the air inflow port **813** is not limited thereto.

The printed circuit board **920** may be provided in the controller housing **910** so as not to be exposed to an outside. The printed circuit board **920** may be provided to be fixed to an inner upper portion of the controller housing **910**.

An electric element **921** may be mounted on the printed circuit board **920** to control the motor assembly **800**. The printed circuit board **920** may have a through-hole **922** which corresponds to the air inflow port **813** and passes through the printed circuit board **920**. The printed circuit board **920** may have an annular shape centering on the through-hole **922**, but a shape of the printed circuit board **920** is not limited thereto. The printed circuit board **920** may be press-fitted and fixed to an inner surface **911** of the controller housing **910**.

The controller assembly **900** may include a heat sink **940**.

The heat sink **940** may radiate heat generated from the controller assembly **900**, may enhance stability of a product, and may allow the suction unit **200***a* to be stably driven.

The heat sink **940** may be formed at the printed circuit board **920**. Specifically, the heat sink **940** may be formed in a circumferential direction centering on the through-hole **922** of the printed circuit board **920**. A plurality of heat sinks **940** may be provided to be spaced apart at regular (or irregular) intervals in the circumferential direction.

The heat sink **940** may define the air path **815** in which the air introduced through the air inflow port **813** flows. Specifically, the air path **815** may be formed by coupling one end of the heat sink **940** with one end of the shroud **811***a*. The air flowing through the air path **815** may be discharged to the air outflow port **814**.

The controller assembly **900** may include the reactor **930**.

The reactor **930** may be disposed in the controller housing **910**. The reactor **930** may absorb a surge voltage or the like generated due to a sudden change in a current, and thus may protect the motor assembly **800** and the controller assembly **900**.

The reactor **930** may be disposed to face the printed circuit board **920** formed in the annular shape. Also, the reactor **930** may be provided to be seated to a reactor seating part **950**. The reactor seating part **950** may include a plurality of legs (not shown) which are disposed to be spaced apart in the circumferential direction of the printed circuit board **920** and to be fixed to the printed circuit board **920**, and a seating groove **951** which is concavely formed in an annular shape so that the reactor **930** is seated thereto. Since the reactor **930** is formed in the annular shape, the seating groove **951** to which the reactor **930** is seated may also be formed in the annular shape. A hollow portion **952** may be provided at a center of the reactor seating part **950** so that the air path **815** passes therethrough.

The reactor **930** may be seated to the reactor seating part **950**, and the reactor seating part **950** may be coupled to the printed circuit board **920**, and thus an assembling of the reactor **930** and the printed circuit board **920** may be performed. Also since the printed circuit board **920** may be press-fitted and fixed to the inner surface **911** of the controller housing **910**, the controller assembly **900** may be assembled as one module.

When the motor assembly **800** and the controller assembly **900** are coupled with each other, the reactor **930** may be disposed above the upper housing **811**. At least one of a pad (not shown) and the diffuser **860** may be provided between the reactor **930** and the upper housing **811**.

The pad serves to prevent noise due to vibration or shaking which may be generated by a gap between the reactor **930** and the upper housing **811**. The pad may be formed of an insulating material so as to reduce the gap between the reactor **930** and the upper housing **811** and also to prevent an electrical effect on each other.

The diffuser **860** may be provided between the reactor **930** and the upper housing **811**. The diffuser **860** may be disposed on an upper surface of the upper housing **811** in the axial direction P of the motor shaft **831**. The diffuser **860** may pass through a coupling hole **816** (see FIG. **15**) formed at the upper housing **811** and may be coupled to the bearing housing **840**. The diffuser **860** may be formed of an insulating material so as to reduce the gap between the reactor **930** and the upper housing **811** and also to prevent the electrical effect on each other. A detailed coupling structure of the diffuser **860** will be described later.

The motor assembly **800** and the controller assembly **900** may be screw-coupled with each other. However, a coupling method between the motor assembly **800** and the controller assembly **900** is not limited thereto.

When the motor assembly **800** and the controller assembly **900** are coupled with each other, an o-ring **960** may be provided between the upper housing **811** and the controller housing **810**. Specifically, the o-ring **960** may be disposed at a contact portion between the upper surface of the upper housing **811** and the inner surface of the controller housing **910** to prevent the air from being introduced into the suction unit **200***a* through the contact portion between the upper surface of the upper housing **811** and the inner surface of the controller housing **910**. The o-ring **960** may have an annular shape. Also, the o-ring **960** may be formed of an elastic material.

Accordingly, the suction unit **200***a* has a structure in which the motor assembly **800** and the controller assembly **900** are detachably assembled. Therefore, when one of the motor assembly **800** and the controller assembly **900** is broken down, it is not necessary to disassemble or cut the entire suction unit **200***a*. Therefore, this structure is effective in maintenance of the suction unit **200***a*.

FIG. **15** is a view illustrating a diffuser assembling process in the suction unit of the vacuum cleaner in accordance with an embodiment of the disclosure, and FIG. **16** is a view illustrating the bearing housing in the suction unit of the vacuum cleaner in accordance with an embodiment of the disclosure. FIGS. **17**A and **17**B are views illustrating the upper housing in the suction unit of the vacuum cleaner in accordance with an embodiment of the disclosure, and FIGS. **18**A and **18**B are views illustrating the diffuser in the suction unit of the vacuum cleaner in accordance with an embodiment of the disclosure. Hereinafter, reference numerals which are not described may correspond to those previously discussed with reference to FIGS. **13** to **14**. Also, matters already described with reference to FIGS. **13** and **14** may be omitted for the sake of brevity.

As illustrated in FIGS. **15** to **18**B, the impeller **850** and the bearing housing **840** may be provided in the upper housing **811**.

The impeller **850** and the bearing housing **840** may be provided in the upper housing **811** in the axial direction P of the motor shaft **831**. The impeller **850** and the bearing housing **840** may be provided in the upper housing **811** to face each other in the axial direction P of the motor shaft **831**. Alternatively, the impeller **850** and the bearing housing **840** may be provided in the upper housing **811** to be coupled with each other in the axial direction P of the motor shaft **831**. Specifically, the impeller **850** may be provided in the upper housing **811** to be located at an upper side in the axial direction P of the motor shaft **831**, and the bearing housing **840** may be provided in the upper housing **811** to be located at a lower side in the axial direction P of the motor shaft **831**.

The bearing housing **840** may include a body **841**.

The body may have a circular plate shape, but a shape of the body **841** is not limited thereto.

An impeller seating part **842** may be formed at the body **841** so that the impeller **850** is seated thereto. The impeller seating part **842** may be formed on an upper surface of the body **841**. Specifically, the impeller seating part **842** may have a shape which is recessed downward in the axial direction P of the motor shaft **831**, such that the impeller **850** is coupled or seated thereto.

The impeller seating part **842** may have a shape corresponding to a rear surface of the impeller **850**. The impeller seating part **842** may include a peak part **843** which is convex upward, as being near the motor shaft **831**, in the axial direction P of the motor shaft **831**. The peak part **843** may have a slope. The slope of the peak part **843** may gradually decrease outward (i.e., become less steep) in a radial direction of the bearing housing **840**. In other words, the slope of the peak part **843** lessens the further away from the motor shaft **831**. The peak part **843** may have a substantially conical frustum shape, or a substantially parabolic frustum shape, for example. However, a shape of the impeller seating part **842** is not limited thereto, and may be changed depending on a shape of the rear surface of the impeller **850**.

The impeller seating part **842** may have a hollow portion **844** provided so that the motor shaft **831** passes therethrough. The hollow portion **844** may be formed at the peak part **843**. The hollow portion **844** may be formed at a center portion of the peak part **843**, but a position of the hollow portion is not limited thereto.

The bearing housing **840** may further include a plurality of coupling grooves **845**.

The plurality of coupling grooves **845** may be formed at the body **841**.

The plurality of coupling grooves **845** may be formed on the upper surface of the body **841**.

The plurality of coupling grooves **845** may be formed along a circumference of the body **841**.

The plurality of coupling grooves **845** may be formed on the upper surface of the body **841** to be located at an outer side of the impeller seating part **842**.

The plurality of coupling grooves **845** may be formed at a boundary of the body **841** to be located along a circumference of the impeller seating part **842**.

The plurality of coupling grooves **845** may have a shape corresponding to a plurality of vanes **862** provided at the diffuser **860**. Also, a number of coupling grooves **845** may correspond to a number of vanes **862** provided at the diffuser **860**.

The diffuser **860** may be coupled with the bearing housing **840**. Specifically, as the plurality of vanes **862** of the diffuser **860** are coupled to the plurality of coupling grooves **845** formed at the bearing housing **840**, the diffuser **860** may be fixed or coupled to the bearing housing **840**. The plurality of vanes **862** may be fitted to the plurality of coupling grooves **845**, but a coupling method between the plurality of vanes **862** and the plurality of coupling grooves **845** is not limited thereto.

The bearing housing **840** may further include at least one leg **846**. The at least one leg **846** may extend from the body **841** facing downward in the axial direction P of the motor shaft **831**.

The bearing housing **840** may be coupled or fixed to the first insulator **822**. Specifically, the at least one leg **846** of the bearing housing **840** may be fitted to an upper surface of the first insulator **822**.

The bearing housing **840** may be formed of a metallic material having high thermal conductivity to enhance rigidity and heat radiation efficiency. As an example, the bearing housing may be formed of aluminum.

The diffuser **860** may be disposed on the upper surface of the upper housing **811** in the axial direction P of the motor shaft **831**.

The diffuser **860** may include a platform **861** and the plurality of vanes **862** may be disposed at the platform **861**.

The platform **861** may have a doughnut or annular shape, but is not limited thereto.

The diffuser **860** may be coupled to the plurality of coupling grooves **845** of the bearing housing **840** so that the plurality of vanes **862** face downward in the axial direction P of the motor shaft **831**.

The platform **861** may be disposed on the upper surface of the upper housing **811** so that a gap is not formed between the platform **861** and the upper surface of the upper housing **811**. Specifically, the platform **861** may be disposed on or coupled to the upper surface of the upper housing **811** so that a gap is not formed between the platform **861** and the upper surface of the upper housing **811**.

The diffuser **860** may include or be formed of a plastic material. When the diffuser **860** is formed of an aluminum alloy for die-castings, the plurality of vanes **862** may be thick, and thus the plurality of thick vanes **862** may obstruct a flow of the air passing through the diffuser **860**. On the other hand, when the diffuser **860** is formed of a plastic material, a thickness of each vane **862** may be easily adjusted, and thus the air passing through the diffuser **860** may flow smoothly. Also, when the diffuser **860** is formed of the plastic material, it is possible to solve an insulation problem with the reactor **930**. Specifically, the reactor **930** may be disposed to face the platform **861**. That is, the reactor **930** may be disposed above the platform **861** of the diffuser **860** coupled to the bearing housing **840** in the axial direction P of the motor shaft **831**. Accordingly, when the diffuser **860** is formed of a metallic material, the insulation problem between the reactor **930** and the diffuser **860** may occur due to the arrangement structure of the reactor **930** and the diffuser **860**. However, when the diffuser **860** is formed of the plastic material, the insulation problem between the reactor **930** and the diffuser **860** may be solved, even though the reactor **930** and the diffuser **860** may be directly in contact with each other.

The upper housing **811** may be disposed between the diffuser **860** and the bearing housing **840**.

A plurality of coupling holes **816** may be formed at the upper housing **811**.

The plurality of coupling holes **816** may be formed at the upper surface of the upper housing **811**.

The plurality of coupling holes **816** may be formed to pass through the upper surface of the upper housing **811**.

The plurality of coupling holes **816** may have shapes corresponding to the plurality of vanes **862** of the diffuser **860**. Also, a number of coupling holes **816** may correspond to a number of vanes **862** provided at the diffuser **860**.

The plurality of vanes **862** of the diffuser **860** may pass through the plurality of coupling holes **816** and then may be coupled to the plurality of coupling grooves **845** of the bearing housing **840**. Therefore, the plurality of vanes **862**, the plurality of coupling holes **816** and the plurality of coupling grooves **845** may be formed to have shapes and numbers corresponding to each other. Further, the plurality of vanes **862**, the plurality of coupling holes **816** and the plurality of coupling grooves **845** may be formed at positions corresponding to each other. Since the plurality of vanes **862** may pass through the plurality of coupling holes **816** and then may be coupled to the plurality of coupling grooves **845**, assemblability of the diffuser **860**, the upper housing **811** and the bearing housing **840** may be enhanced. That is, in a process in which the diffuser **860** is coupled to the bearing housing **840**, since the plurality of vanes **862** pass through the plurality of coupling holes **816** and then are coupled to the plurality of coupling grooves **845**, an assembly of the diffuser **860**, the upper housing **811** and the bearing housing **840** may be firmly maintained.

The diffuser **860** may be in close contact with the upper housing **811**. The diffuser **860** and the upper housing **811** may be adhered, fastened, or welded to each other so as to enhance a sealing effect between the diffuser **860** and the upper housing **811**.

An adhering of the diffuser **860** and the upper housing **811** may be performed by an adhesive. That is, adhesion or sealing between the plurality of vanes **862** and the plurality of coupling holes **816** may be enhanced using the adhesive.

The diffuser **860** and the upper housing **811** may be welded using thermal welding. That is, the thermal welding may be performed while the plurality of vanes **862** are inserted or coupled into the plurality of coupling holes **816** and thus the adhesion or sealing between the plurality of vanes **862** and the plurality of coupling holes **816** may be enhanced. However, a sealing method between the diffuser **860** and the upper housing **811** is not limited thereto.

FIGS. **19**A and **19**B are views illustrating a diffuser and upper housing assembly formed by an insert injection molding in the suction unit of the vacuum cleaner in accordance with an embodiment of the disclosure. Hereinafter, reference numerals which are not described may correspond to those previously discussed with reference to FIGS. **13** to **18**B.

As illustrated in FIGS. **19**A and **19**B, the diffuser **860** and the upper housing **811** may be formed integrally.

The diffuser **860** and the upper housing **811** may be formed integrally by insert injection molding. Specifically, the upper housing **811** formed of the metallic material may be manufactured, and then the diffuser **860** formed of the plastic material may be insert-injected, and thus the diffuser **860** and the upper housing **811** may be formed integrally. The metallic material of the upper housing **811** may include or be formed of aluminum.

An assembling method of the diffuser **860**, the upper housing **811** and the bearing housing **840** may be variously applied, regardless of the kind of the motor. That is, FIGS. **13** to **19**B have been described centering on an AC motor, but also may be applied to the BLDC motor, the DC motor or the like.

Since the plurality of vanes are disposed to extend outward in the radial direction of the inner casing, the length of the path through which the air discharged from the impeller flows may be sufficiently ensured, and thus the suction performance of the vacuum cleaner may be enhanced.

By extending lengths of the plurality of vanes, instead of enlarging a diameter of the inner casing or the outer casing, it may be expected to satisfy the small or compact size of the vacuum cleaner and also to enhance the suction force of the vacuum cleaner.

By forming at least one communication part at the plurality of vanes, it may be possible to reduce the noise generated from the vacuum cleaner.

By arranging the plurality of guides to be inclined with respect to the axial direction of the impeller, it may be possible to reduce path resistance.

By forming the coupling holes or coupling grooves at the upper housing and the bearing housing, it may be possible to enhance the assemblability of the diffuser.

Although example embodiments of the disclosure have been shown and described, it would be appreciated by those skilled in the art that changes may be made to these embodiments without departing from the principles and spirit of the disclosure, the scope of which is defined in the claims and their equivalents.

What is claimed is:

1. A vacuum cleaner, comprising:

a main body; and

a suction unit provided in the main body, the suction unit including:

an impeller configured to suck air by rotating about an axis thereof,

a diffuser configured to guide air discharged from the impeller, the diffuser including:

an inner casing having a seating hole with a diameter greater than a diameter of the impeller,

an outer casing having a continuous cylindrical wall and spaced apart from an outer circumference of the inner casing in a radial direction of the inner casing so as to form a path between the inner casing and the outer casing through which the air discharged from the impeller flows, and

a plurality of vanes disposed at the inner casing configured to guide the air discharged from the impeller to the path, the plurality of vanes protruding toward the outer casing to cross at least a part of the path, and

a motor module including a first seating housing to which the impeller is seated thereto, a second seating housing coupled to the first seating housing, and a motor disposed between the first seating housing and the second seating housing,

wherein the plurality of vanes are disposed so that an outermost radial end of each of the plurality of vanes directly contacts the continuous cylindrical wall of the outer casing.

2. The vacuum cleaner according to claim **1**, wherein the diffuser further includes a plurality of guides disposed on the path and provided between the inner casing and the outer casing.

3. The vacuum cleaner according to claim **2**, wherein the plurality of guides connect the inner casing and the outer casing.

4. The vacuum cleaner according to claim 2, wherein the plurality of guides extend in an axial direction of the impeller.

5. The vacuum cleaner according to claim 4, wherein the plurality of guides are disposed to be inclined with respect to the axial direction of the impeller.

6. The vacuum cleaner according to claim 4, wherein the plurality of guides are disposed in parallel with the axial direction of the impeller.

7. The vacuum cleaner according to claim 2, wherein at least a part of the plurality of guides comprise a curved surface.

8. The vacuum cleaner according to claim 2, wherein the plurality of guides are integrally formed with the plurality of vanes and are located below the plurality of vanes in the axial direction of the impeller.

9. The vacuum cleaner according to claim 2, wherein the plurality of guides comprises edge parts located at an upper stream side of the path in a flowing direction of the air discharged from the impeller, and

the plurality of vanes are disposed to be discontinuously located on the edge parts.

10. The vacuum cleaner according to claim 2, wherein the plurality of guides comprises edge parts located at an upper stream side of the path in a flowing direction of the air discharged from the impeller and are configured to connect the inner casing and the outer casing, and

the plurality of vanes are disposed to be located on at least a part of the edge parts.

11. A vacuum cleaner, comprising:

a main body; and

a suction unit provided in the main body, the suction unit including:

an impeller configured to suck air by rotating about an axis thereof, and

a diffuser configured to guide air discharged from the impeller, the diffuser including:

an inner casing,

an outer casing having a continuous cylindrical wall and spaced apart from an outer circumference of the inner casing in a radial direction of the inner casing,

a path provided between the inner casing and the outer casing so that the air discharged from the impeller flows therethrough, and

a plurality of blades formed integrally with at least one of the inner casing and the outer casing to connect the inner casing and the outer casing, wherein an outermost radial end of each of the plurality of blades directly contacts the continuous cylindrical wall of the outer casing, and

a motor module including a first seating housing to which the impeller is seated thereto, a second seating housing coupled to the first seating housing, and a motor disposed between the first seating housing and the second seating housing.

12. The vacuum cleaner according to claim 11, wherein the plurality of blades comprise a plurality of vanes disposed on the inner casing to extend outward in a radial direction of the inner casing.

13. The vacuum cleaner according to claim 11, wherein the path comprises an entrance located at an upper stream side in a flowing direction of the air discharged from the impeller, and

the plurality of blades comprises a plurality of vanes disposed to cross at least a part of the entrance.

14. The vacuum cleaner according to claim 11, wherein the plurality of blades comprises a plurality of vanes having bodies disposed between the inner casing and the outer casing in a radial direction of the inner casing, and

at least one communication part is formed at the plurality of vanes.

15. The vacuum cleaner according to claim 14, wherein the at least one communication part is formed at the bodies located on the path so that air introduced into the path passes therethrough.

16. The vacuum cleaner according to claim 11, wherein the plurality of blades comprises a plurality of vanes disposed on the inner casing to protrude outward in the radial direction of the inner casing, and

the plurality of vanes are gradually inclined along a rotating direction of the impeller from the inner casing toward the outer casing.

17. The vacuum cleaner according to claim 11, wherein the plurality of blades comprise a plurality of guides extended in an axial direction of the impeller to partition the path, and are coupled with the outer casing.

18. The vacuum cleaner according to claim 17, wherein the plurality of guides are gradually inclined along a rotating direction of the impeller from an upper stream side of the path in a flowing direction of the air discharged from the impeller to a lower stream side of the path.

19. The vacuum cleaner according to claim 11, wherein the plurality of blades comprises:

a plurality of vanes disposed on the inner casing to cross at least a part of the path in a radial direction of the inner casing; and

a plurality of guides connected to the plurality of vanes in the axial direction of the impeller and disposed between the inner casing and the outer casing, and

at least a part of at least one side of the plurality of vanes and the plurality of guides is formed with a curved surface.

20. A suction unit for a cleaning apparatus, the suction unit comprising:

a housing including:

a first housing in which an air inlet port is provided,

a third housing in which an air outlet port is provided, and

a second housing disposed between the first housing and the third housing in an axial direction, and including a plurality of coupling holes;

a motor assembly including:

a shaft, elongated in the axial direction and configured to rotate, and

a bearing housing configured to rotatably support an upper portion of the shaft, an upper surface of the bearing housing including a plurality of coupling grooves;

an impeller coupled to the shaft and configured to suck air into the suction unit via the air inlet port; and

a diffuser disposed about an outer circumference of the impeller, the diffuser comprising:

an inner casing,

an outer casing,

a diffuser path formed between the inner casing and the outer casing and through which air discharged from the impeller flows, and

a plurality of blades which extend from one of the inner casing and the outer casing toward the other one of the outer casing and the inner casing, to cross at least a part of the diffuser path in a radial direction of the inner casing, and at least a part of each of the plurality of the blades extends through respective coupling holes of the second housing and is coupled with the respective coupling grooves of the upper surface of the bearing housing.

21. The suction unit of claim **20**, wherein

the air inlet port is disposed at an upper portion of the first housing, and

the air outlet port is disposed at a lower portion of the third housing.

22. The suction unit of claim **21**, wherein:

the second housing corresponds to the outer casing of the diffuser.

23. The suction unit of claim **20**, wherein:

the second housing is configured to be coupleable to and detachable from at least one of the first housing and the third housing, and is disposed at the upper portion of the shaft between the diffuser and the bearing housing,

the third housing is disposed at a lower portion of the shaft, and

the diffuser is formed of plastic.

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